WATER WORKS & SEWERAGE

DO MORE FOR YOUR COUNTRY —AND YOURSELF

6th WAR LOAN

6th WAR LOAN

BY BUYING THAT EXTRA WAR BOND YOU WILL BE DOING BOTH

IS PERFORMING DISTINGUISHED SERVICE

If ever a chemical deserved a military medal, it's chlorine! It is always with the advance spearhead of attack . . . Its compounds land with the first invasion troops . . . Serving on duty everywhere in the field during every campaign — fighting the battle against water-borne disease.

Chlorine and its compounds serve both the army and the navy from the time a man enters the service until he's mustered out.

Chlorine's most important function is the protection of drinking water. But it's also used by the medical corps as a bactericide. It's a bleach and sanitizing agent in camp laundries. And, in footbaths it guards against common infections.

All this is vitally important — and to this service Penn Salt devotes a large percentage of its output of chlorine and chlorine compounds. With facilities expanded and service augmented by this wartime experience, Penn Salt is now equipped to serve you better when peace returns.

Perchloron
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PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

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NEW YORK, CHICAGO, ST. LOUIS, PITTSBURGH, CINCINNATI, MINNEAPOLIS, WYANDOTTE, TACOMA

WATER WORKS & SEWERAGE, December, 1944. Volume 91, Number 12. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1923, at the Post Office at Chicago, Ill., under act of March 3, 1879.

THERE'S A WHALE OF A LOT OF ENGINEERING SERVICE IN CHICAGO SEWAGE EQUIPMENT

ENGINEERED FOR SPECIFIC SERVICE:

THESE exclusive Chicago Pump Company products have the advantages of closest co-ordination between engineering research, product design, development, and application experience. Each one was designed for its specific service and developed to do its job right before being offered for sale. Improvements have been made as unusual installation and operation problems were met. Our installation engineers and our operating engineers report directly to the Sewage Equipment Engineering Department, where complete records are kept and co-ordinated.

Consulting Sanitary Engineers specify Chicago sewage treatment plant equipment in complete confidence that they are engineered to do their jobs right, will last a long time and will give the most economical service.

- "PACKAGE" PLANTS FOR SMALL COMMUNITIES.
- WIDE BAND AIR DIFFUSION SYSTEMS.
- COMMINUTORS FOR AUTOMATIC SCREENING AND CUTTING COARSE SOLIDS UNDER WATER.
- SCRU-PELLER PRIMARY SLUDGE PUMP.

Write for literature containing engineering data and application information.

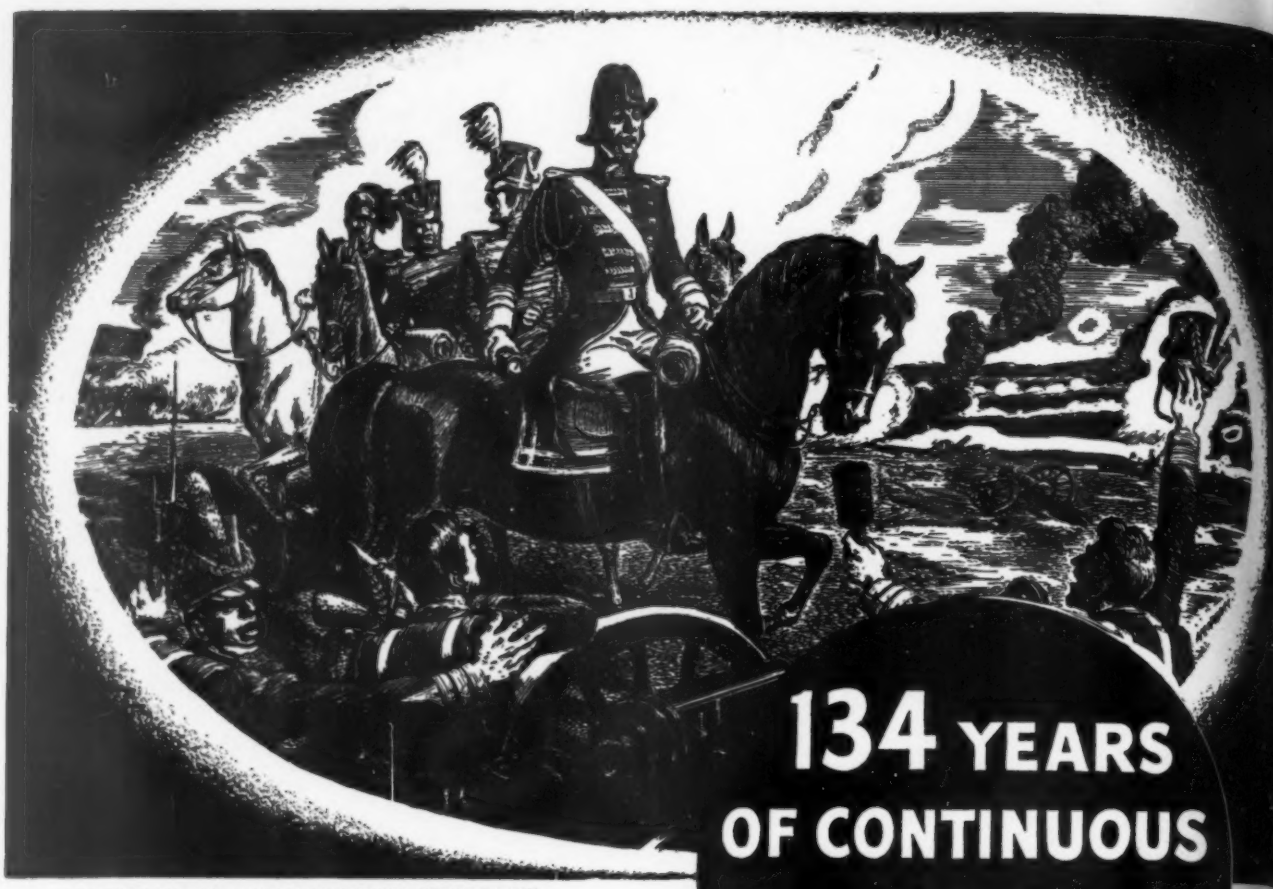
CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

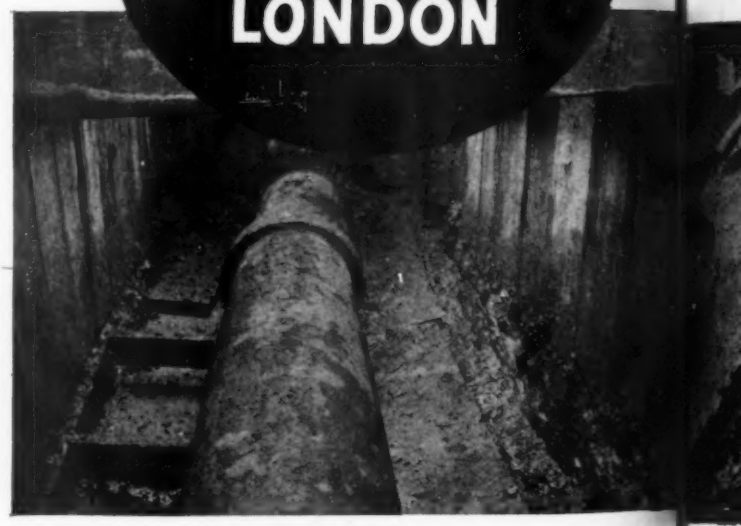


CAST IRON PIPE LAID IN LONDON BEFORE THE BATTLE OF WATERLOO IS STILL IN SERVICE.

134 YEARS OF CONTINUOUS SERVICE IN LONDON

BETWEEN 1810 and 1812—before Wellington defeated Napoleon at Waterloo—the cast iron water main, shown at right, was installed in London, England. It is still in service (unless recently bombed out). For when it was uncovered for inspection, and photographed, a few years ago, engineers pronounced it "as tight as when new." Before the war, 200-year-old cast iron water mains were known to be in service throughout Europe.

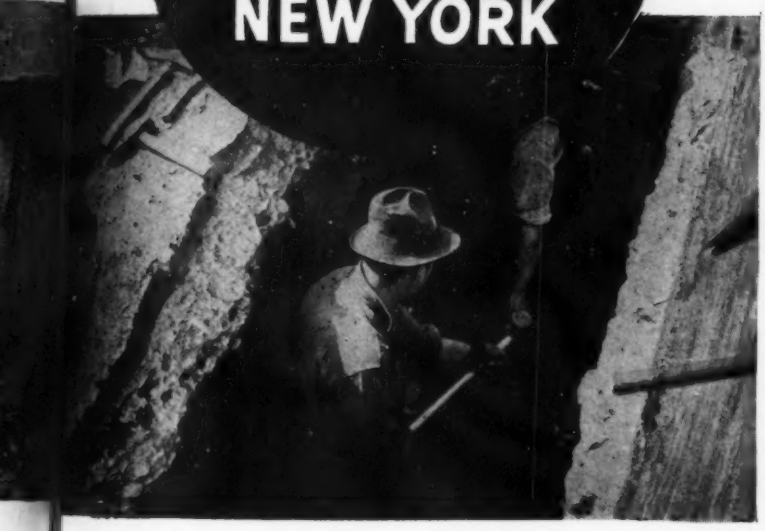
So when you specify cast iron pipe for current or postwar construction, you know one thing for certain—it will serve for centuries, in its original location or elsewhere. If the line has to be relocated or abandoned or replaced by larger diameters, you also know that cast iron pipe can be taken up and relaid, or salvaged for cash. You may also know that cast iron pipe costs far less to maintain than any other pipe used for water distribution mains, as proved by a survey conducted by a prominent engineering publication.



[Section of a cast iron water main laid in London between 1810 and 1812 and still functioning (at last report) after 134 years of continuous service.]

LINCOLN WAS ELECTED CAPTAIN BY HIS COMPANY IN THE BLACK HAWK WAR—113 YEARS AGO.

113 YEARS OF CONTINUOUS SERVICE IN NEW YORK



[Section of New York's oldest cast iron water main, installed 113 years ago in "Greenwich Village" and still in service.]

IN 1831, when Abraham Lincoln enlisted in the Black Hawk Indian War, the Common Council of the City of New York authorized the installation of a cast iron water main in what is now "Greenwich Village." It is still in service.

Today, more than a century later, the methods by which cast iron pipe is produced have undergone revolutionary changes. Metallurgical, laboratory and production controls have been developed. A recent and fundamental forward step is the new Law of Design for cast iron pipe in underground service, approved by the American Standards Association and sponsored by official organizations representing pipe users.

Thus, you can take it for granted that the cast iron pipe made today by our members, has not only *long life* as proved by generations of service the world over, but is more economical than ever.

CAST IRON

Cast Iron Pipe Research Association
Thomas F. Wolfe, Engineer, Peoples Gas Building, Chicago 3

CASE HISTORIES

It's a matter of record that Cooper-Bessemer Diesel and sludge gas engines, are doing a highly successful job in many of today's outstanding municipal power and sewage plants. Instructive case histories of some of these installations are now available and a set is yours for the asking.

Cooper-Bessemer's reliable, efficient gas engines for sewage plant use are built in various types and sizes from 150 to 1000 horsepower.

●

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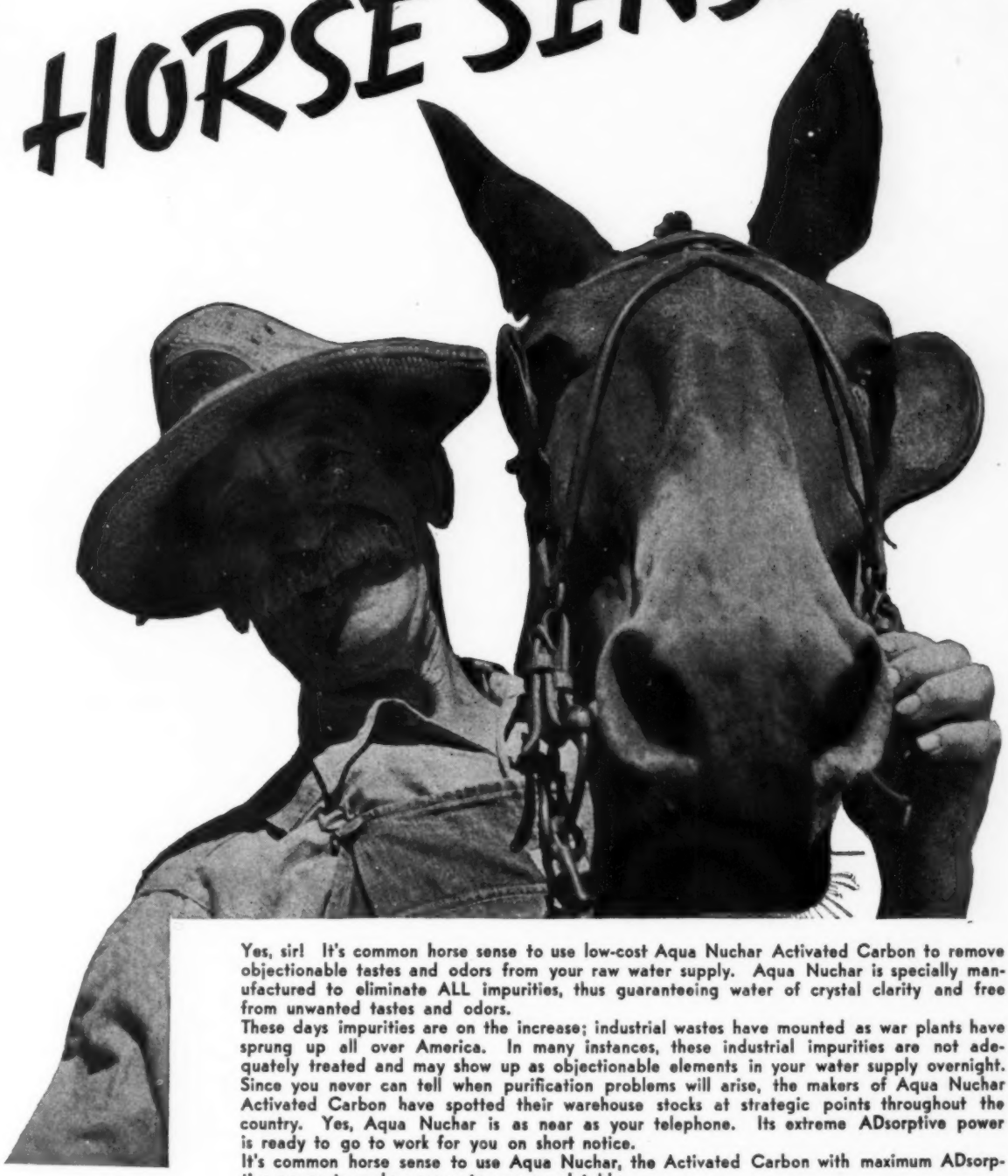
MOUNT VERNON, OHIO — GROVE CITY, PA.

New York Washington Houston Dallas Tulsa Shreveport
Los Angeles St. Louis Seattle

HORSE SENSE!



Yes, sir! It's common horse sense to use low-cost Aqua Nuchar Activated Carbon to remove objectionable tastes and odors from your raw water supply. Aqua Nuchar is specially manufactured to eliminate ALL impurities, thus guaranteeing water of crystal clarity and free from unwanted tastes and odors.

These days impurities are on the increase; industrial wastes have mounted as war plants have sprung up all over America. In many instances, these industrial impurities are not adequately treated and may show up as objectionable elements in your water supply overnight. Since you never can tell when purification problems will arise, the makers of Aqua Nuchar Activated Carbon have spotted their warehouse stocks at strategic points throughout the country. Yes, Aqua Nuchar is as near as your telephone. Its extreme ADsorptive power is ready to go to work for you on short notice.

It's common horse sense to use Aqua Nuchar, the Activated Carbon with maximum ADsorptive power to make your water more palatable.

BLUEPRINT NOW!

But above all, remember there is a war yet to be won. Maintain equipment to assure operation at 100% efficiency.

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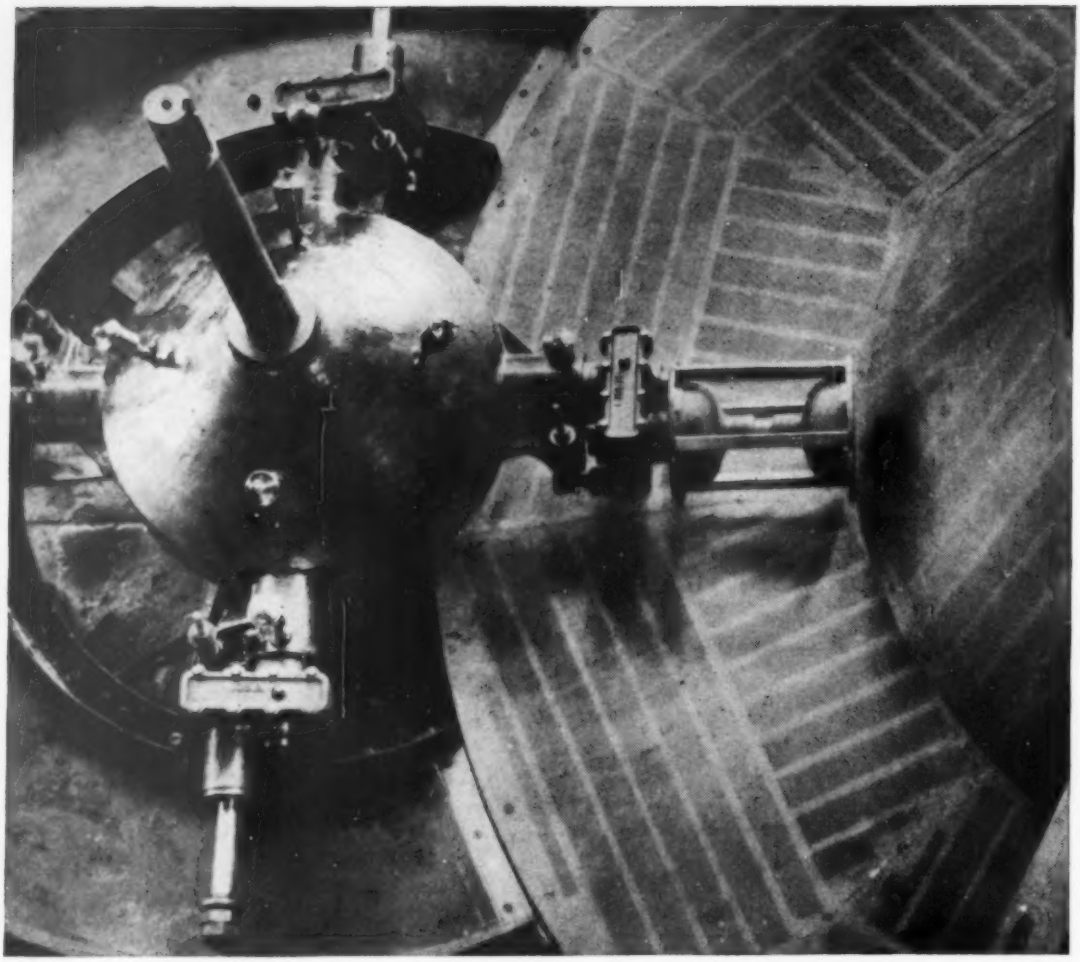
INDUSTRIAL CHEMICAL SALES



Shop assembly view of 12-foot EVERDUR sewage disc screen with revolving brush mechanism (brush staves not shown). Designed and furnished by Krajewski-Pesant Mfg. Corp., New York City, for the Stafford Springs, Conn., Sewage Treatment Works.

SEWAGE PLANTS THAT ARE BUILT TO *last* USE *Everdur* EQUIPMENT

Here are just a few of the well-known plants using Everdur*... and the service record of this corrosion resistant metal to date:

ELIZABETH, N. J.	17 YEARS
DEARBORN, MICH.	12 YEARS
HAGERSTOWN, MD.	12 YEARS
CHICAGO, ILL.	10 YEARS
BOUND BROOK, N. J.	8 YEARS
WARD'S ISLAND, N. Y.	7 YEARS
RAHWAY, N. J.	7 YEARS
TALLMAN'S ISLAND, N. Y.	6 YEARS
SAN FRANCISCO, CAL.	6 YEARS

Everdur, the copper-silicon alloy of The American Brass Company, combines the tensile strength of mild steel with the corrosion resistance of pure copper. It is available in forms suitable for hot or cold working and for welding by commonly used methods with rods of the same material. Its outstanding use in the sewage field is due to its high resistance to corrosion and wide adaptability that includes its effective use in light weight, wrought, built-up structures. 44177

EVERDUR METAL

is used in sewage works for Coarse and Fine Screens, Swing Gates, Built-up Sluice Gates, Coarse Bar Rack Aprons, Effluent Weirs and Scum Weirs, Structural Scum Baffle Brackets, Troughs, Screen Hoppers, Orifices, Baskets, Anchors, Ladders, Float Gage Chains, Valve Springs, Manhole Steps, Guides, Walkways, Bars and Plates, Bolts and Nuts.

*Reg. U. S. Pat. Off.

ANACONDA *Everdur* METAL

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company—In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

BUY WAR BONDS...*THE VICTORY YOU DEPEND ON, DEPENDS ON YOU*

Air lines are a key service in activated sludge plants, and a highly important service in others. Due to the moisture that is always present, corrosive conditions are severe, and may cause excessive maintenance . . . unless proper protective steps are taken. To provide this protection, many of the country's leading plants use wrought iron exclusively. This material has not only proven itself highly successful in resisting the corrosive conditions involved, but its tightly adherent scale minimizes the danger of clogging the diffuser plates.

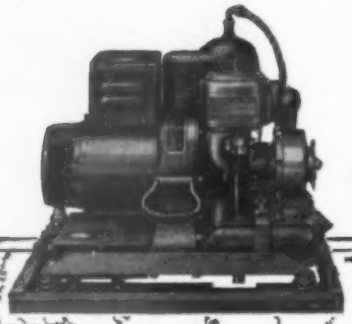
The Jones Island Sewage Treatment Plant at Milwaukee, Wis., is a particularly interesting installation, because of the large amount of pipe used, and because of the service obtained. When the plant was built in 1925, the engineers—aiming for maximum durability—used 53,000 feet of galvanized wrought iron for the branch air lines. The best evidence of how well wrought iron justified this confidence is found in the fact that when an addition was built ten years later, branch air lines were again specified "wrought iron," and over 20,000 additional feet were employed.

Wrought iron's unusual durability in this service is a direct result of its unusual structure. Tiny fibers of glass-like silicate slag are threaded through a body of high-purity iron. These fibers help to halt, and diffuse any corrosive attack, thus avoiding the pitting that causes ordinary materials to fail. Then the fibers anchor the initial protective film, that shields the underlying metal.

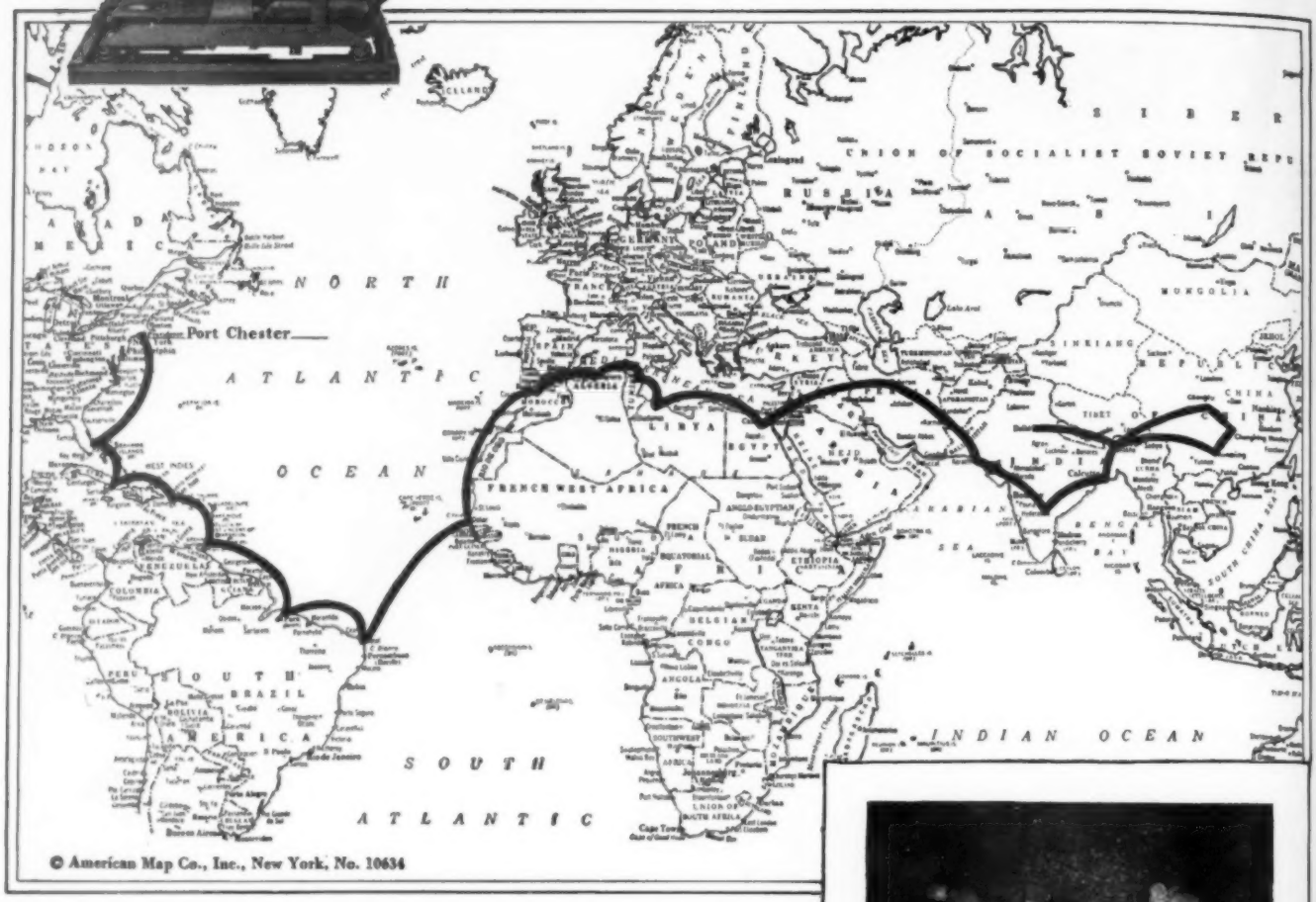
Our Engineering Service Department will be glad to give you details of the use of wrought iron in air lines. You will also find some helpful information in our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations." May we send you a copy?

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON



HERE'S A TRIP
that will do you a Lot of Good



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From Port Chester, New York, to Chungking, China . . . with plenty of stops in between.

Just one trip of many . . . made by a Homelite service man . . . to get facts . . . to find out how Homelite Portable Generators are performing and standing up under the tough conditions of war.

On trips like these . . . to Alaska, Africa, India and all the theatres of war, Homelite men get the "dope" first hand. And they transmit their information back to our engineering department where new advancements in design and performance are constantly being made to meet the pace.

Yes, trips like these will do you a lot of good. For they have piled up a wealth of priceless experience that will enable us to give you better generators, better pumps and better blowers, than you ever had before.

THE BENEFITS FOR YOU

Better cold weather operation . . . better hot weather operation . . . new cooling methods . . . advanced type bearings . . . less trouble and maintenance . . . much longer wear . . . more power . . . more portability . . . these and many other features will be but standard advantages of the New Homelite Gasoline-engine-driven Generators, Pumps and Blowers that you will get and use, after the war is over.

HOMELITE CORPORATION
PORT CHESTER, NEW YORK

PORTABLE PUMPS • GENERATORS • BLOWERS

Product improvement through

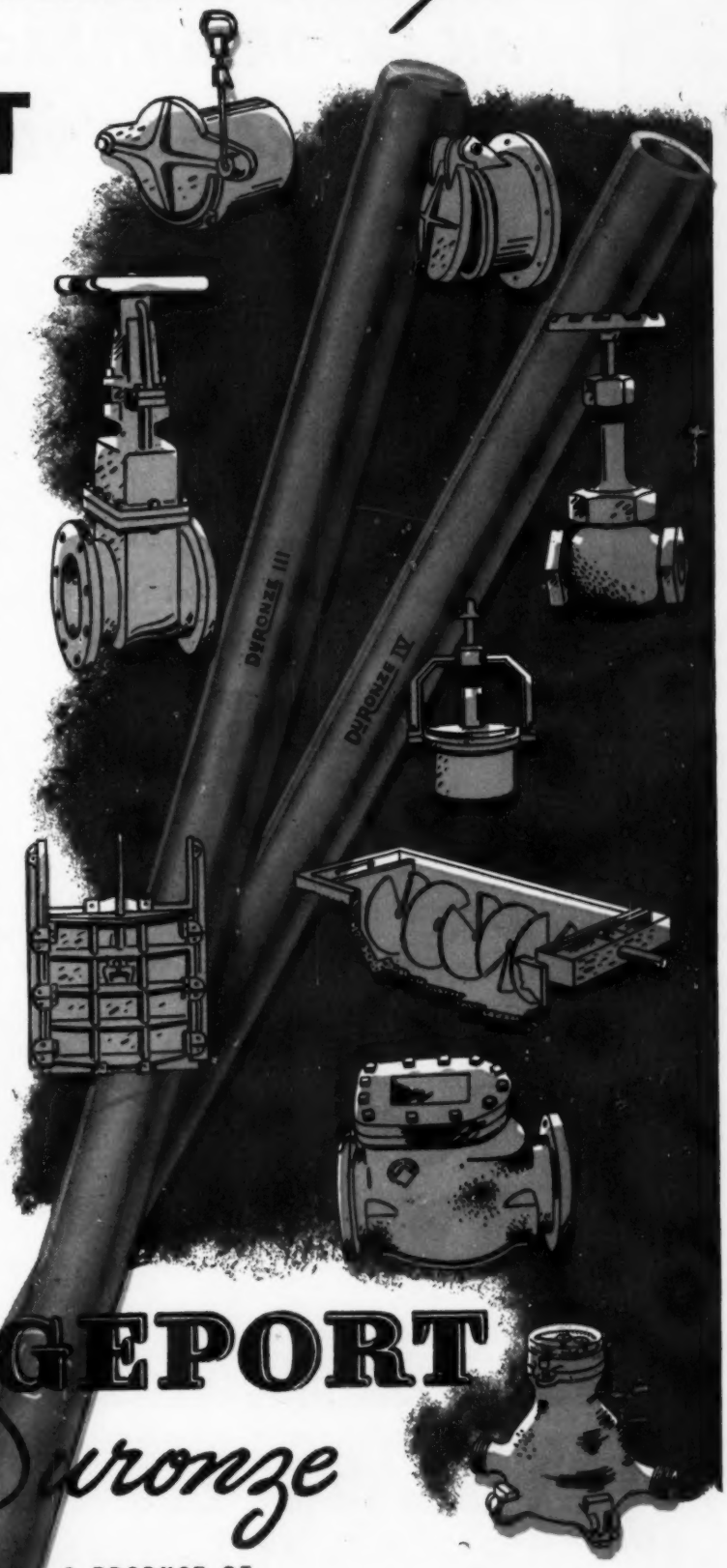
BRIDGEPORT DURONZE

Corrosion Resisting Alloys for use in Water Works and Waste Disposal Operations

Failures due to corrosion attack and wear of equipment used in sewage and industrial waste disposal jeopardize continuity of service and add heavily to maintenance and replacement costs. Under the severest conditions, Bridgeport's DURONZE III and DURONZE IV alloys provide maximum service advantages and minimum costs for a wide range of applications in this field.

DURONZE alloys, supplied in several compositions for specific applications, are exceptionally resistant to corrosion, abrasion and wear; also, they possess great strength, hardness, and good machinability. They will outlast many materials now in use.

Among the possible applications for Bridgeport's DURONZE III and IV alloys are valve stems and parts for gate and globe valves, weirs, gates, filters, meters, walkways, baffles, troughs, chains, plates, bars, and many other miscellaneous uses. But the best proof of the extra service values provided by DURONZE alloys under extreme corrosion conditions, is *actual test in service.* If you are a user or a manufacturer of water works or waste disposal equipment, we invite you to investigate Bridgeport engineered DURONZE alloys for a part, made from ordinary materials that do not stand up, and prove to yourself how you may increase its useful life... without changing its design. Send *today* for Bridgeport's 80-page new DURONZE Manual—or communicate with our Technical Advisors about your particular corrosion problems.



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"Bridgeport" BRASS CO. BRIDGEPORT 2, CONN. • *Established 1865*

AN IMPORTANT PACKAGE TO WRAP-UP NOW!

Getting many of the boys back home for Christmas this year is out of the question, but it won't be long before demobilization gets underway. Our "Welcome Home" will be hollow indeed if we have no jobs to offer. That new construction and replacement work that has been accumulating—have you got it all wrapped-up ready to let the contracts? Your **BLUEPRINT NOW** committee again urges you to settle the financing arrangements, the plans, and all the other details.

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The Centriline process is a rapid and economical method of reconditioning pipe lines of 30" and more. It consists of first cleaning the main and then applying, by centrifugal force, a dense cement mortar lining of required thickness, mechanically troweled to a smooth finish. This is done underground, in place.

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The largest water meter contracts ever awarded in the United States named "Watch Dog" meters.

This choice is due to these facts:

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3. Constantly-improved Worthington-Gamon meter designs have developed an unusual ability to measure accurately even the smallest quantities of water.

No other water meter manufacturer maintains as extensive service facilities as Worthington-Gamon—24 district offices in 24 leading cities. Worthington water meter technicians and Worthington Research Laboratories will help you work out a plan for better, lower-cost metering.

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Power Plant Equipment • Turbines & Turbo-Generator Sets • Condensers, Heaters, Ejectors • Water Purification Equipment • Pumps, Stationary and Portable Compressors • Air Conditioning & Refrigerating Equipment • Power Transmission Equipment • Construction Machinery, Equipment for Mines • Locomotive Feedwater Heaters • Welding Positioning Equipment • Liquid Meters

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The Meter Specified in the Largest Contracts Ever Awarded in the U. S.

"Watchdog" models . . . made in standard capacities from 20 G P M up; frostproof or split case in household sizes. All parts interchangeable with your present meters of our manufacture. Write for Bulletin.

...FOR TOMORROW

When Johnny and his buddies come marching home, it's up to every community to have plenty of big jobs for their own men to do. One sound way to insure the future of your local citizens is to plan important public works projects NOW—projects which will give your men the steady employment they'll need during the period of "war-to-peace conversion."

The manufacture and installation of Lock Joint Concrete Pipe for your water supply lines, sewerage and drainage programs provide one of the best methods for putting your local men to work quickly—right in your own home town. Past experiences have proven that by erecting temporary local plants as much as 90% of your local labor can be used in building these dependable and economical pipelines. In addition, the Lock Joint Pipe Company buys the bulk of supplies and materials from your own merchants—and thus, most of the cost of the project remains in your community.

Whether your project is large or small, for the present or the future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY

Established 1905

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Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill. Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

American Bio-Activation

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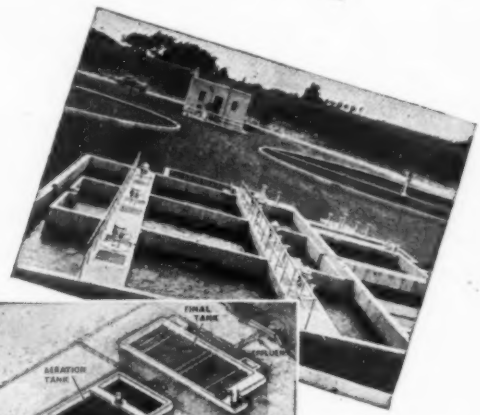

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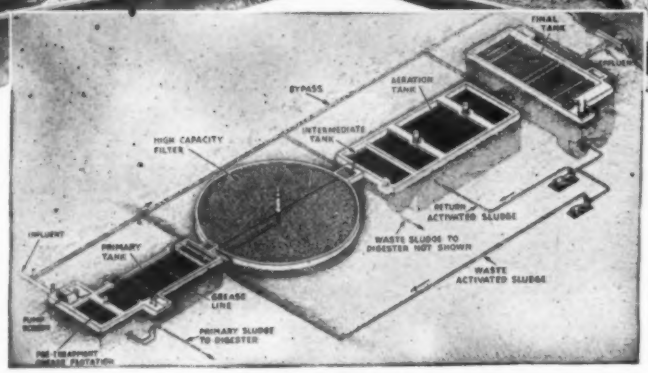

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Bio-Activation combines the best qualities of both the trickling filter and the activated sludge process to produce a completely stable, nitrified effluent, low in B. O. D. and suspended solids.

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	Domestic, Malt, Brewery and Canning Wastes	
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Raw Waste	342	370
Primary Effluent	235*	134
Influent to Filter	510†	.....
Filter Effluent	99	143
Intermediate Effluent	58	65
% Reduction Filter Influent through Intermediate Effluent	89.5	.....
Final Effluent	13	15
% Overall Removal	97.5	96

*High Soluble 5 BOD from malt and brewery.
†Pea waste; 600-1200 ppm. 5 BOD, added in primary effluent.

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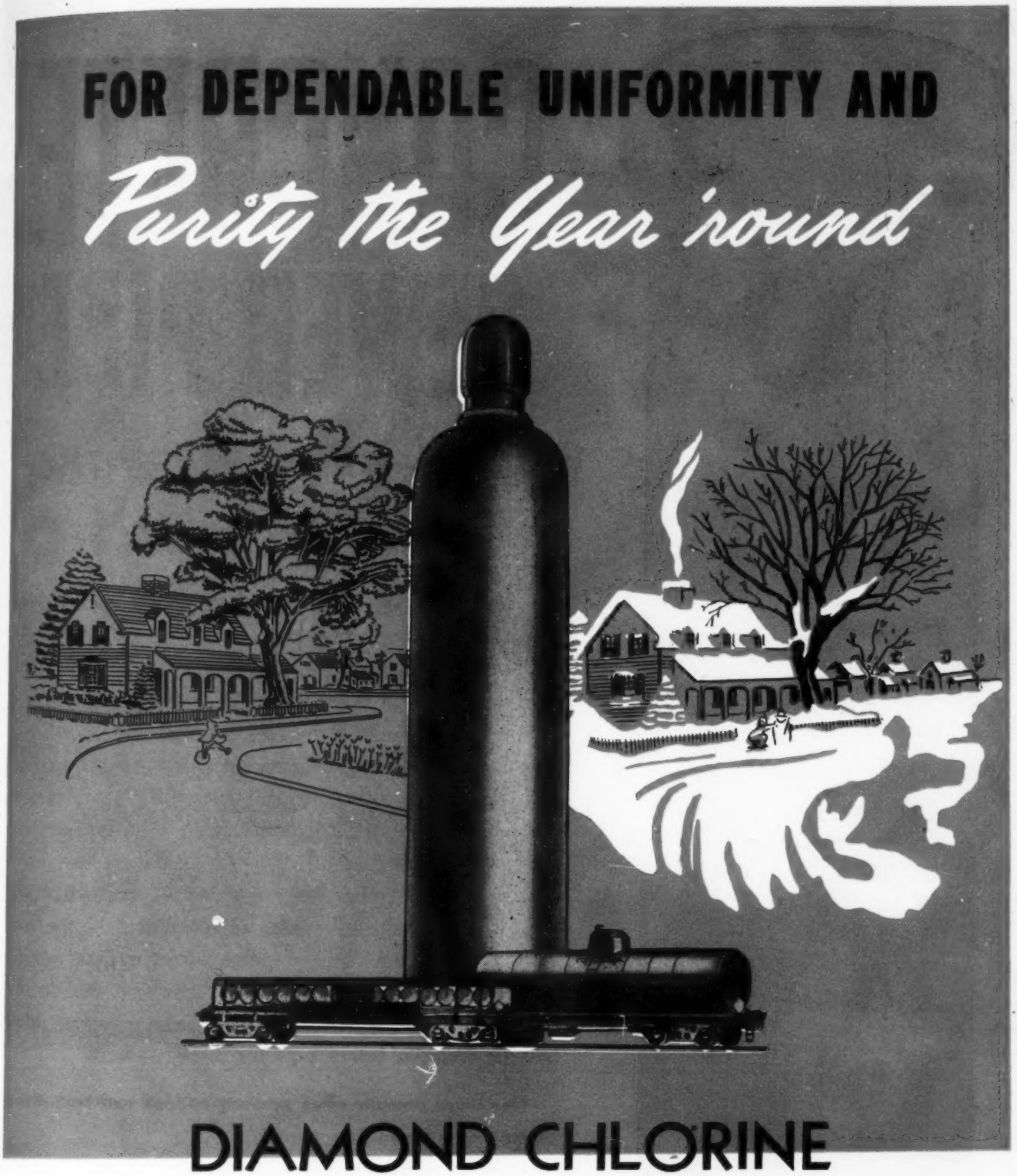
Purity the Year 'round



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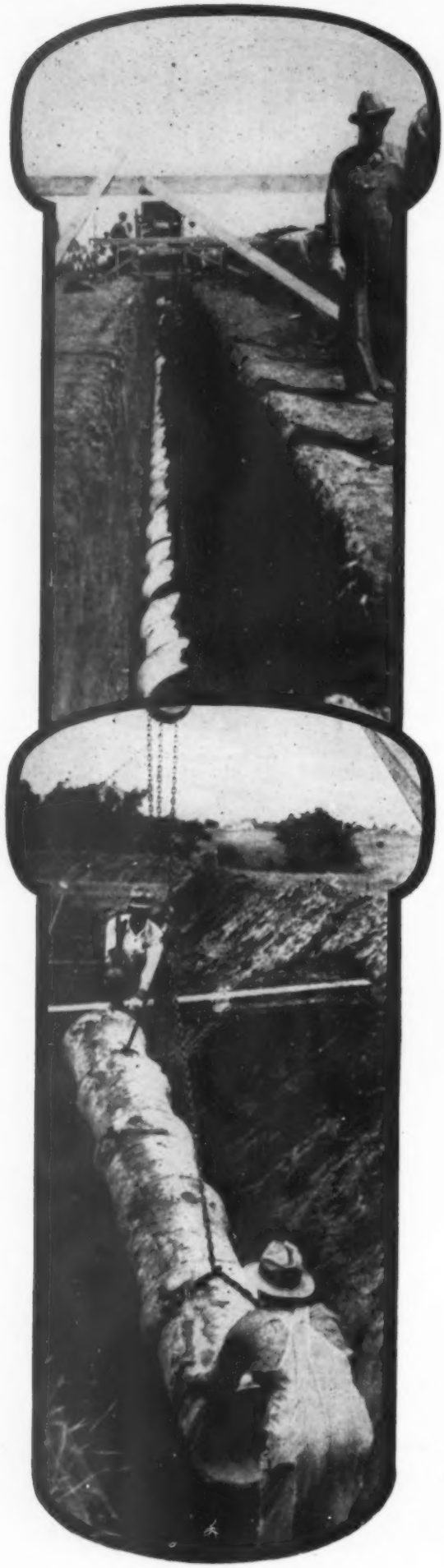
is always a sound specification

Because you must be able to count definitely on the quality and purity of your chlorine, you will appreciate the strict control of every step of the process by which Diamond Chlorine is made. Careful checking and supervision insures the exact duplication of results, summer or winter, year after year.

Gain these advantages by specifying DIAMOND Chlorine for all your requirements.

DIAMOND ALKALI CO., PITTSBURGH 22, PA., AND EVERYWHERE



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excellent performance under severe test

During the construction of a 12,000 ft. 18 in. concrete pipe sanitary outfall sewer (not reinforced) for the University of Oklahoma, Norman, Oklahoma, in the spring of 1938, a flood inundated a section of the line that had been bedded but had not been backfilled.

This caused the pipe line to float, disrupting the grade and alignment, requiring relaying of 400 ft. Because the joints were carefully made with Portland cement mortar, five joints of 3 ft. pipe—a 15 ft. section—were raised intact and placed on a timber grillage, then relaid to establish line and grade, as illustrated. Only four joints of the initial pipe had to be replaced with new pipe.

When you design sewerage systems now and in the post-war period, specify concrete sewer pipe and reinforced concrete sewer pipe for these reasons:

1. **Maximum strength when properly bedded and back-filled;**
2. **Maximum hydraulic capacity;**
3. **Long life expectancy;**
4. **Furnished locally at reasonable cost by our members. List mailed on request.**

AMERICAN CONCRETE PIPE ASSOCIATION

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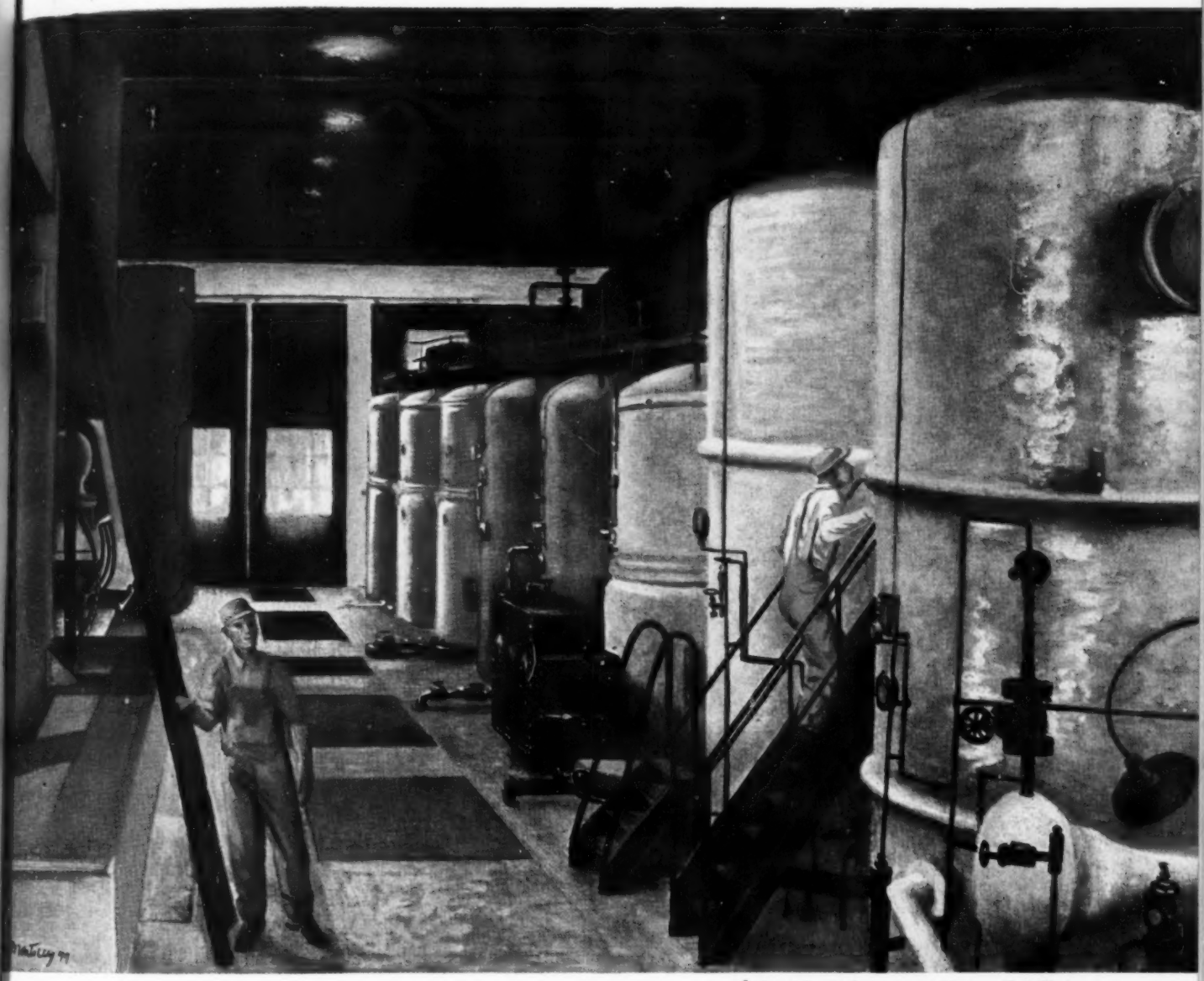
Timely Experience . . .



Section of Caustic Evaporators at Niagara Alkali Plant

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Niagara ALKALI COMPANY

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CAUSTIC POTASH • CAUSTIC SODA • PARADICHLOROBENZENE • CARBONATE OF POTASH • LIQUID CHLORINE

HORTON ELEVATED TANKS provide municipalities with 5 distinct benefits:

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3. a reduction in pumping costs resulting in an appreciable savings to water consumers.
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5. the ironing out of pressure fluctuations in the water system during periods of heavy demand.

The 1,000,000-gal. Horton radial-cone bottom tank shown above provides Tucson, Arizona, with these 5 benefits. Write our nearest office for complete information and quotations.

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New York 6.....3390-165 Broadway Bldg.
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Tulsa 3.....1646 Hunt Bldg.
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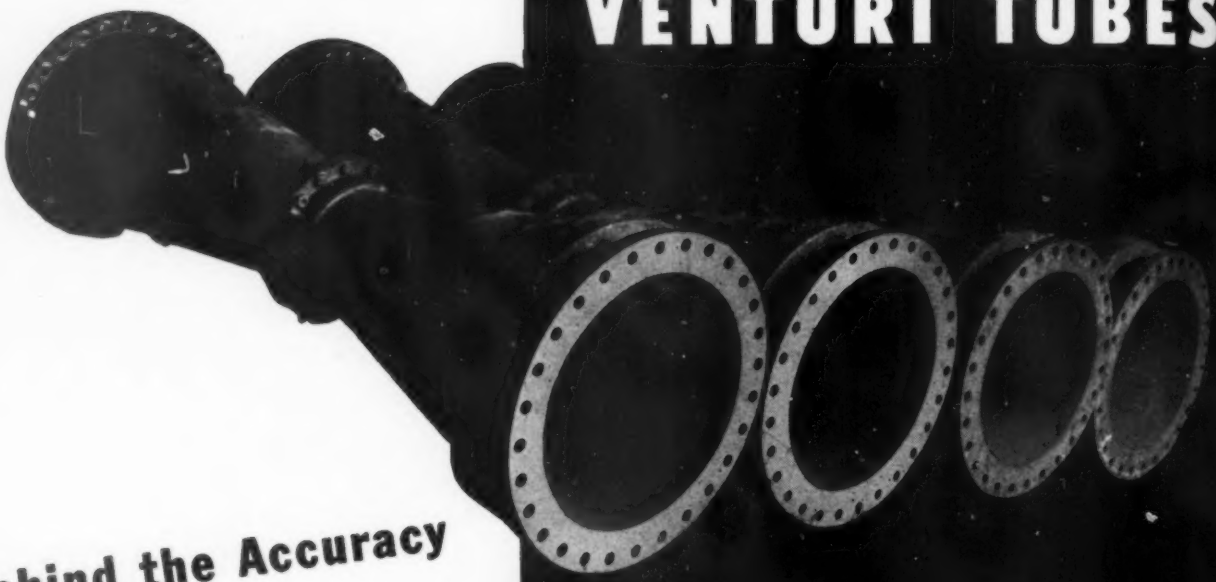
Specify SIMPLEX VENTURI TUBES



Behind the Accuracy of the Flow Meter is the quality of the PRIMARY DEVICE

FOR WATER, SEWAGE, PROCESS LIQUIDS, ETC.

1. ***Homologous*** — as to type and form.
2. ***Uniform*** — Cast and machined surfaces.
3. ***Accurate*** — As to piezometer workmanship.
4. ***Dependable*** — As to head-quantity relations produced.

All based on many years devoted to the manufacture and application of Venturi tubes, and continued research.

SIMPLEX VALVE & METER CO.
6743 UPLAND STREET, PHILADELPHIA 42, PENNA.

BLUE PRINT NOW!

Managers and Department Heads Cities of 5000 or More

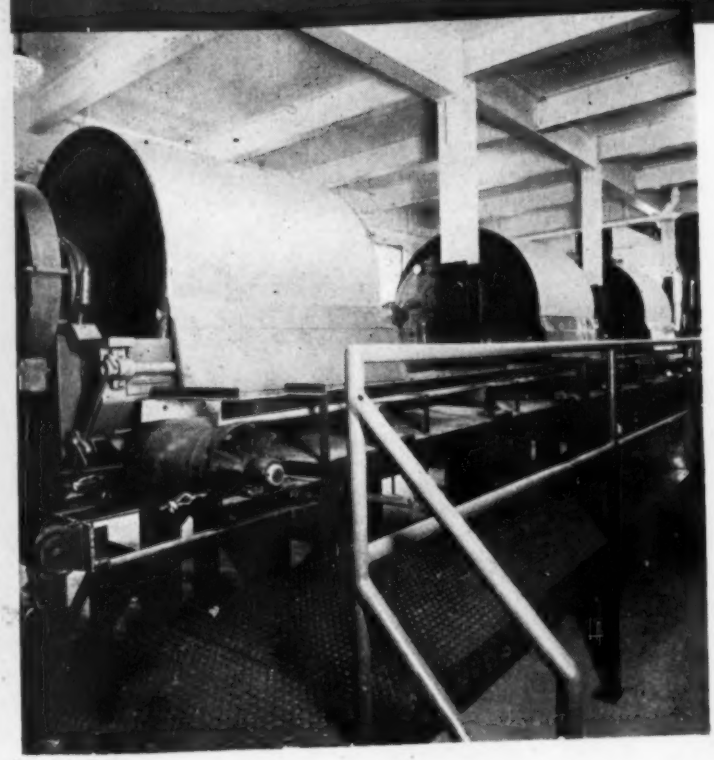
Make the installation of a modern sewage disposal plant a post-war project.

Plan now—consider cost of plant, space requirements and location, type of equipment to render most efficient service, methods to produce dry sludge, cost of operation and facilities for insuring cleanliness and odor-free disposal of sludges.

Eimco Sewage Sludge Filters

ASSURES MAXIMUM CAPACITY
WITH MINIMUM MAINTENANCE

Blueprint Now!



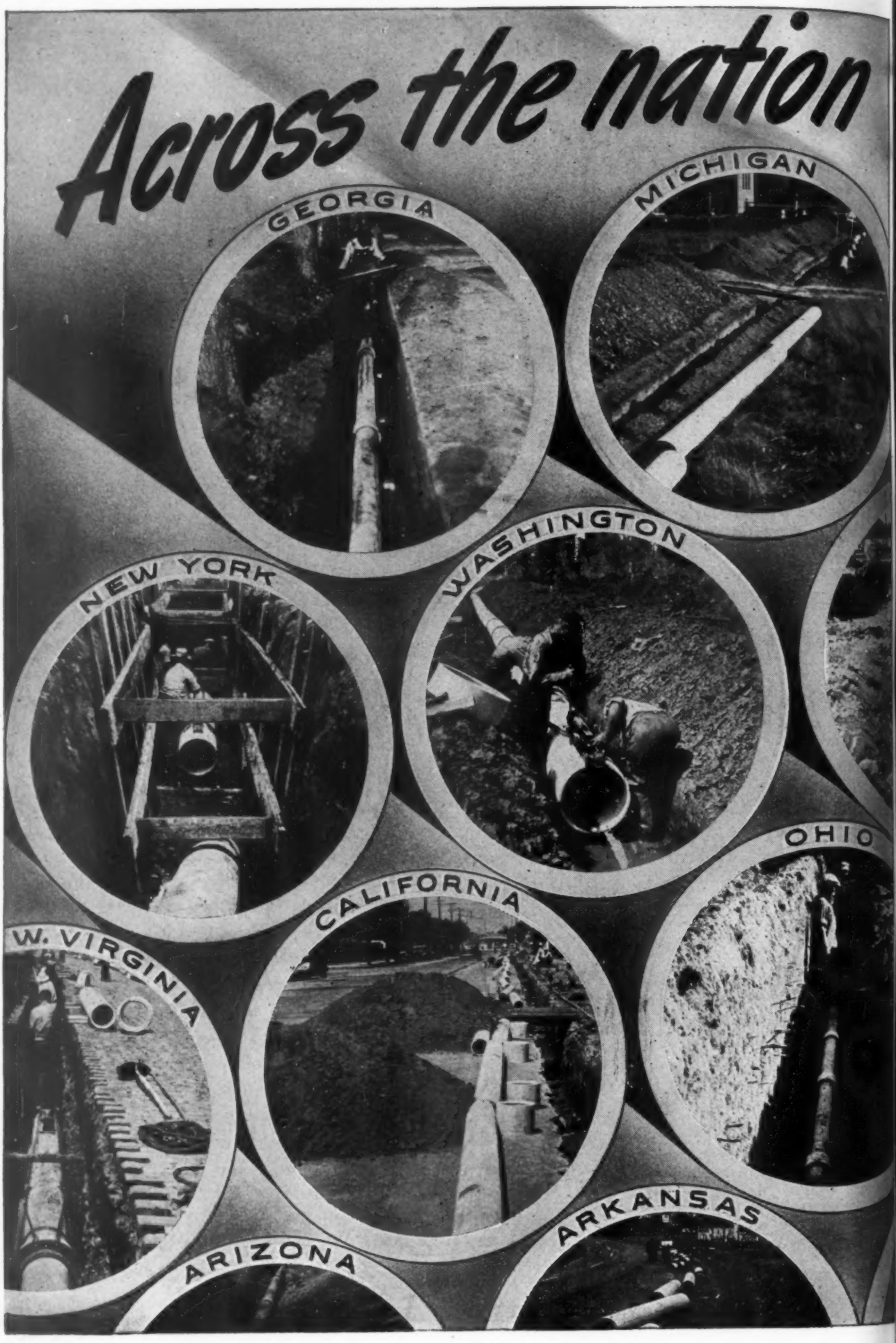
In deciding on sludge-drying equipment, bear in mind that Eimco sludge Filters require less than 1% of the space needed for sand beds, operate in all kinds of weather under cover, continuously produce a dry sludge which may be sacked and used for fertilizer or may be easily burned; are cheaper to operate than sand beds and eliminate the need for a large operating staff.

Eimco engineers welcome an opportunity to aid in planning post-war Sewage Treatment.

A 79 **EIMCO**

THE EIMCO CORPORATION

Executive Offices and Factories: Salt Lake City 8, Utah
Branches: New York, Chicago, El Paso, Sacramento, St. Louis


Across the nation
GEORGIA
MICHIGAN
NEW YORK
WASHINGTON
OHIO
CALIFORNIA
W. VIRGINIA
ARIZONA
ARKANSAS

..they're getting efficient water transportation at low cost with

TRANSITE PIPE

THOUSANDS of Johns-Manville Transite Pipe installations are at work carrying water for cities, towns, and villages all over America—economically providing a high rate of flow that can never be choked off by tuberculation. Made of asbestos and cement, compressed under great pressure, J-M Transite Pipe has these advantages:

Tuberculation No Problem. Non-metallic in composition, Transite cannot tuberculate. Its initial high-flow coefficient (C=140) can never be reduced by tuberculation.

Low Maintenance. Transite's corrosion-resistance and maintained strength contribute to its low upkeep cost.

Tight, Flexible Joints. Wide sweeps can be made with straight lengths because the Simplex Coupling stays tight even when the line is deflected as much as 5° at each joint.

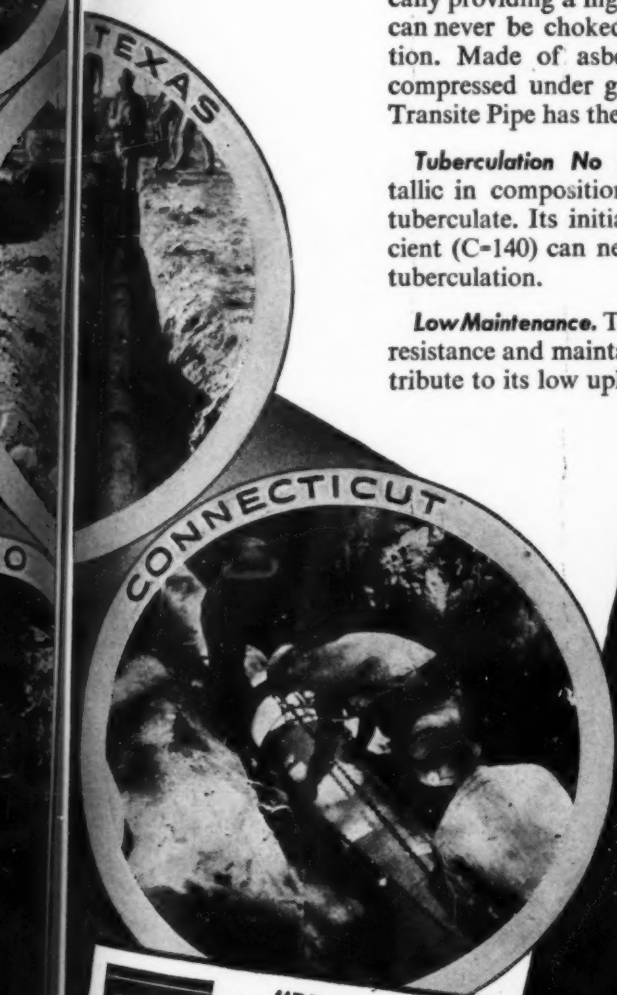
Easy Handling. Light-weight Transite Pipe requires fewer men for handling. Only the larger sizes need mechanical handling equipment.

Rapid Assembly. Even inexperienced crews form tight joints easily, quickly with the Simplex Coupling.

* * *

For the facts, write to J-M for Transite Pipe Booklet TR-11A. For details on Transite Sewer Pipe for more efficient sewage disposal systems, get TR-21A. Johns-Manville, 22 E. 40 St., New York 16, N. Y.

TRANSITE PIPE IS AGAIN AVAILABLE FOR PROMPT SHIPMENT



"Blueprint Now!"

Create jobs for our returning soldiers! And benefit our cities, towns and villages. Plan *now* to improve and expand your water and sewerage systems. As an aid, the Committee on Water and Sewage Works Development has a booklet entitled "Blueprint Now!" If you do not have a copy, write the Committee at Suite 2110, 500 Fifth Ave., New York 18, N. Y.

Johns-Manville

Asbestos

TRANSITE PIPE

FOR EFFICIENT, ECONOMICAL WATER AND SEWER LINES

JOHNS-MANVILLE JM PRODUCTS

IMPORTANT

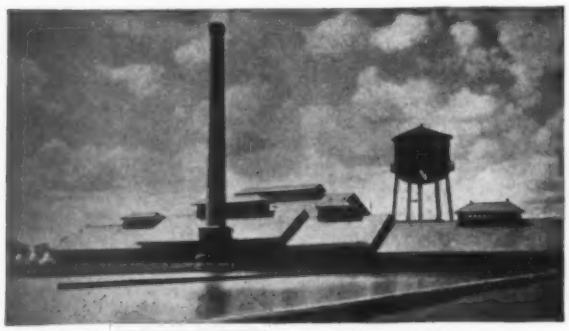
Public Health must be maintained!

The necessity of maintaining public health in war time is self-evident. Municipal officers in charge of water purification and sewage disposal have a vital responsibility in guarding the nation's health which should not be underestimated as a contributing factor to final victory.

However, the problems of maintaining public health are *becoming increasingly difficult in the face of material shortages and transportation handicaps.* General's "Alum" will help do the job right. But to ease the situation in regard to *Aluminum Sulfate* as much as possible, won't you place your orders as far ahead as you can so that we may schedule our production on an efficient basis.

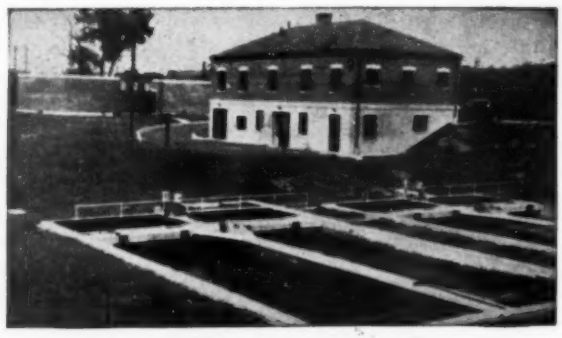
Why Most American Cities Prefer General Chemical Aluminum Sulfate

General Chemical Aluminum Sulfate is an especially developed "Alum." High quality and constant uniformity have given it a *time-tested* reputation among water works engineers and sewage plant operators, who know its reliability through experience.



★ FOR WATER WORKS

1. Makes water crystal clear.
2. Longer filter runs are obtainable.
3. Is economical, used properly will conserve chlorine supplies . . . because it does not require oxidation to make it effective.
4. Superior in tests against other coagulants.
5. High in quality, its constant uniformity can be counted upon.



★ FOR SEWAGE PLANTS

1. Clean, easy to handle and economical to use.
2. Simple application, requires only low cost feeding apparatus and minimum attention.
3. Clear, colorless effluents are possible.
4. Precipitated sludge digests readily.
5. Treated digested sludge dries quickly, without odor.

GENERAL CHEMICAL COMPANY

GENERAL CHEMICAL COMPANY

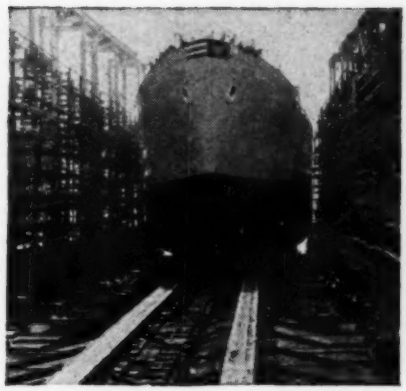
40 RECTOR STREET, NEW YORK 6, N. Y.

Technical Service Offices: Atlanta • Baltimore • Boston • Bridgeport (Conn.) • Buffalo • Charlotte (N.C.) Chicago • Cleveland • Denver • Detroit • Houston • Kansas City • Milwaukee • Minneapolis New York • Philadelphia • Pittsburgh • Providence (R. I.) • St. Louis • Utica (N. Y.)

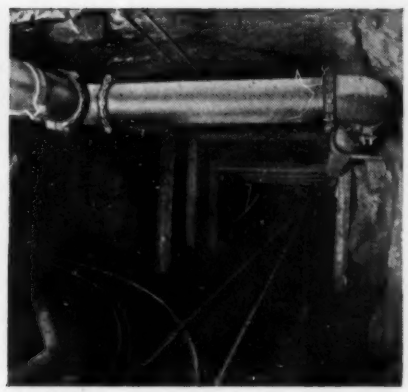
Pacific Coast Technical Service Offices:
Los Angeles • San Francisco • Seattle, Wenatchee and Yakima (Wash.)

In Canada: The Nichols Chemical Co., Ltd. • Montreal • Toronto • Vancouver

1 Speedy Victaulic Couplings for Invasion Pipelines in Italy, France, the Pacific.

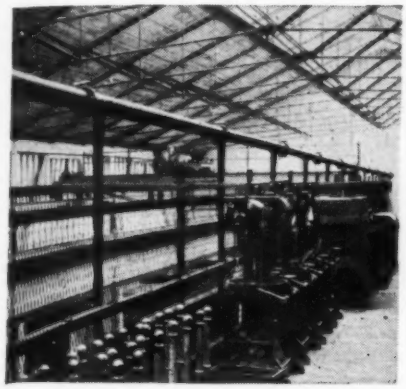


2 Flexible Victaulic Couplings for America's "bridge of ships."

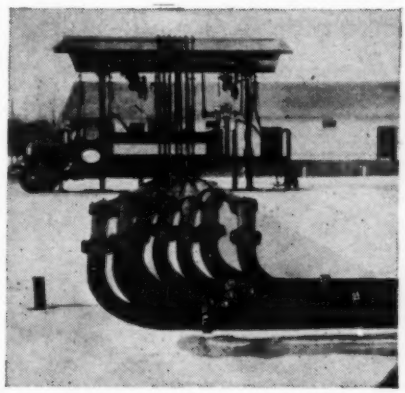


3 Self-aligning Victaulic Couplings for America's all-important mines!

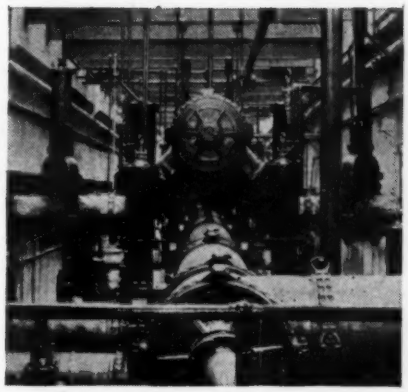
A BUSY YEAR...



4 Dependable, mechanically locked Victaulic Couplings that save man-hours for America's War Industry.

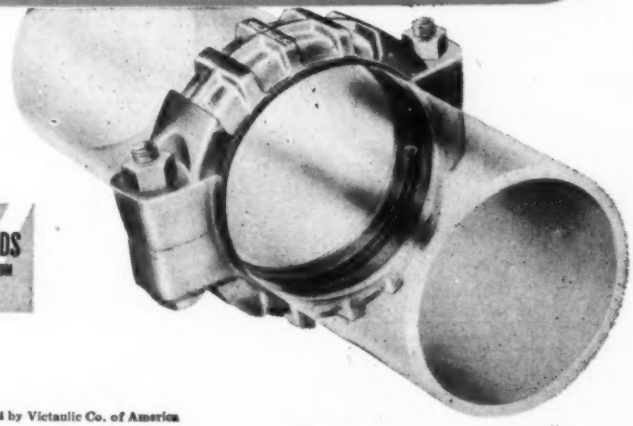


5 Proven, leak-tight Victaulic Couplings continuing more than a quarter century of service for America's Oil Industry.



6 Easily installed Victaulic Couplings for America's essential Municipal Works.

A BUSY FUTURE...



WAR BONDS
A PIPE LINE FROM YOU TO HIM

The very features which have made Victaulic Couplings indispensable in War . . . make them vital in reconversion, vital to the years of peacetime business ahead. Our couplings and Victaulic Full Flow Fittings will be available from the word "GO." For detailed information write VICTAULIC COMPANY OF AMERICA, 30 Rockefeller Plaza, New York 20, N. Y. *Other offices:* Victaulic Inc., 727 West 7th St., Los Angeles 14, California; Victaulic Co. of Canada, Ltd., 200 Bay Street, Toronto.

VICTAULIC

Reg. U. S. Pat. Off.

SELF-ALIGNING PIPE COUPLINGS AND FULL-FLOW FITTINGS

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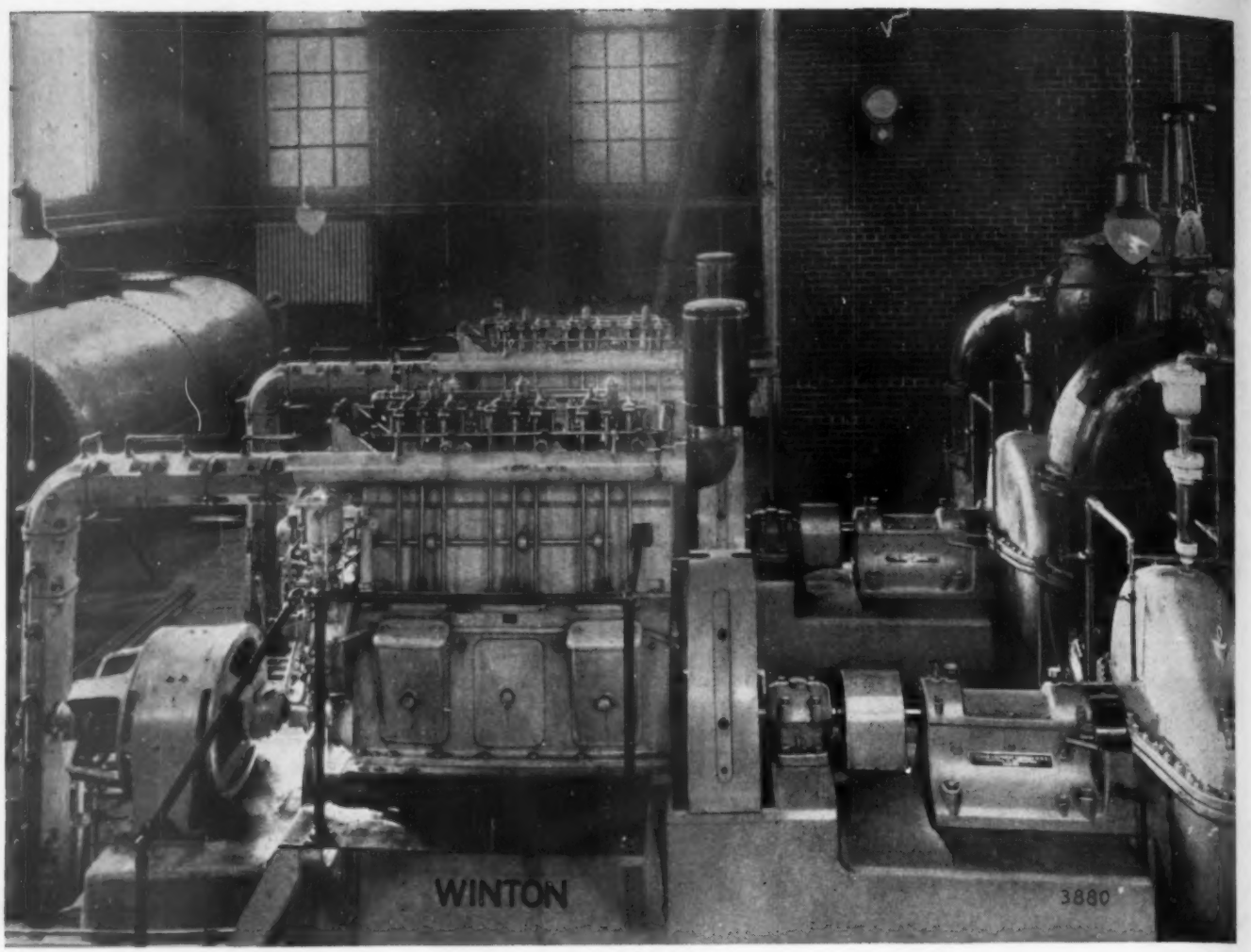
OIL MINING MARINE MUNICIPAL INDUSTRIAL



ANOTHER EXAMPLE OF

BRAINTREE-WEYMOUTH SEWAGE STATION
Two De Laval diesel driven sewage pumps 15 m.g.d. each

UNDIVIDED RESPONSIBILITY

In 1934 the Metropolitan District Commission, State of Massachusetts, designed the above pumping station to include diesel driven pumping units, diesel generator units and auxiliaries together with all station piping and wiring.

Our contract for all of this equipment completely installed was awarded to Turbine Equipment Company of New England.

Turbine Equipment Company with 36 years of experience as equipment contractors are in a position to give you the same advantages of undivided responsibility in the installation of complete water works and sewage equipment.

TURBINE EQUIPMENT COMPANY

75 WEST STREET — NEW YORK 6, N. Y.
80 Federal St. — Boston 10, Mass.

REPRESENTING AND SERVICING

DE LAVAL STEAM TURBINE CO.
DE LAVAL SEPARATOR CO.
PEERLESS PUMP CO.
YEOMANS BROS. CO.
COCHRANE CORP.

Attention!

WATER WORKS OFFICIALS

The letter reproduced herewith tells its own story—Mathieson's new Chlorine Dioxide water-treatment technique is no longer in the experimental stage. When Mathieson Sodium Chlorite—from which Chlorine Dioxide is generated—is again available in quantity after the war, many other communities will be able to enjoy the advantages of this amazing technique for removing objectionable tastes and odors. Full information will be sent upon request.

CITY OF NIAGARA FALLS
NEW YORK

DATE October 20, 1944

FROM H. W. Clark, City Manager

TO Mr. George W. Dolan, President
The Mathieson Alkali Works, Inc.
60 East 42nd Street
New York, N. Y.

Dear Mr. Dolan:

On behalf of the administration of the City of Niagara Falls, New York, I am taking this means of expressing our satisfaction over the present quality of the municipal water supply.

The chlorine dioxide treatment developed by the technical staff of your organization has been applied to the entire pumpage here for the past five months. During this time the elimination of objectionable tastes and odor from the water supply has been maintained at a high level of performance.

It is my belief that your company has made an outstanding contribution to water works practice.

Very truly yours,

H. W. Clark

HWC:SW

H. W. Clark, City Manager

Mathieson
CHLORINE DIOXIDE

THE MATHIESON ALKALI WORKS (INC.) 60 EAST 42nd STREET, NEW YORK 17, N. Y.
SODIUM CHLORITE PRODUCTS . . . CAUSTIC SODA . . . SODA ASH . . . BICARBONATE OF SODA . . . LIQUID CHLORINE . . . BLEACHING POWDER . . . H T H PRODUCTS
AMMONIA, ANHYDROUS & AQUA . . . FUSED ALKALI PRODUCTS . . . SYNTHETIC SALT CAKE . . . DRY ICE . . . CARBONIC GAS . . . SODIUM METHYLATE

SOLVAY

TRADE MARK REG. U. S. PAT. OFF.

Industry's Dependable Source for

ALKALIES

and related products

Soda Ash

Calcium Chloride

Caustic Soda

Causticized Ash

Ammonium Chloride

Para-Dichlorobenzene

Para-Baco*

Liquid Chlorine

Caustic Potash

Sodium Nitrite

Potassium Carbonate

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 RECTOR STREET NEW YORK 6, N. Y.

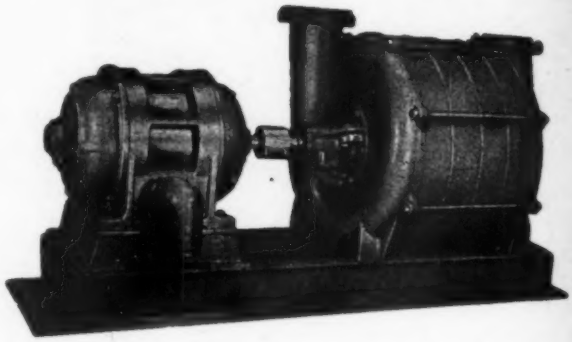
BRANCH SALES OFFICES:

Boston • Charlotte • Chicago • Cincinnati • Cleveland
Detroit • New Orleans • New York • Philadelphia
Pittsburgh • St. Louis • Syracuse

*Trade Mark Reg. U. S. Pat. Off.

Economical Blower Operation in Sewage Treatment

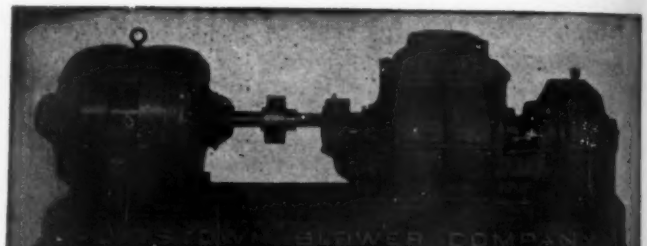
Whether your need is for a blower of the centrifugal type or the rotary type, Allen Billmyre can supply the blower that will give you maximum efficiency under your particular working conditions — at minimum operating and maintenance cost.



For Constant Pressure at All Volumes

BILLMYRE TURBO BLOWERS

These centrifugal type blowers require no pressure, relief or power controls. There are no gears, valves, sliding or reciprocating parts, and no internal lubrication is necessary. Operation is economical, trouble-free. Maintenance costs are minimum.



For Constant Volume at All Pressures

POTTSTOWN ROTARY BLOWERS

Because of their close, accurate impeller clearance, these blowers deliver positive displacement with maximum volumetric efficiency. Friction is eliminated, as there are no sliding parts—hence no need of internal lubrication. Less power is required to operate Pottstown Blowers, and their long life makes them widely popular in sewage disposal plants.

Send postcard for detailed information on these two types of blowers.

Allen Billmyre Company, 449 Fayette Ave., Mamaroneck, N. Y.

ALLEN BILLMYRE

BLOWERS AND EXHAUSTERS

Serious scale problem in Wichita stopped by Calgon*

—*Water superintendent Rogers proves it himself!*

M. E. Rogers, Superintendent of Production, Municipal Water Supply Plant, Wichita, Kansas.

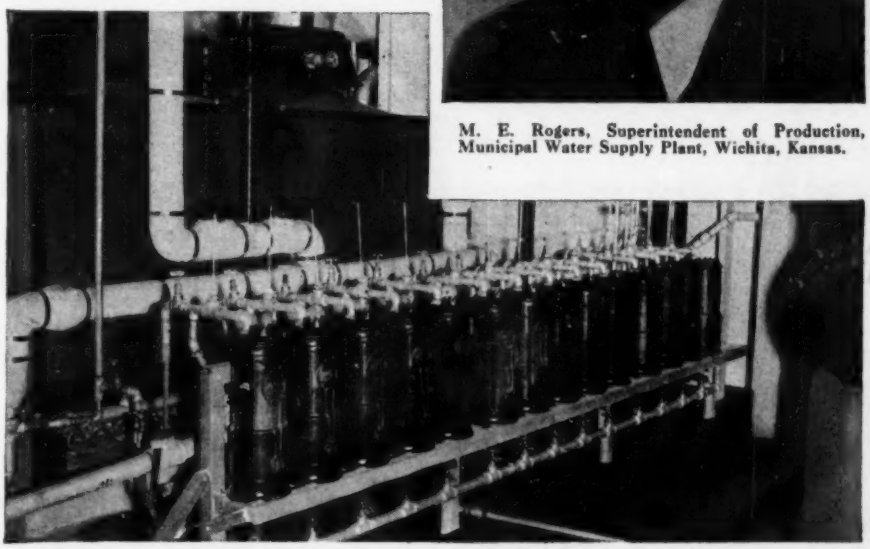
WHEN Wichita's new water plant went into service a few years ago, they encountered serious trouble with scale formation. In some restaurants where large volumes of water were heated to high temperatures, heater coils would fill with scale within a few weeks. In homes, several hundred coils a month were being lost.

Mr. Rogers, superintendent, set out to stop this trouble as fast as possible. He started to feed 2 ppm. Calgon. Results were apparent throughout the system within two days. Within a week alkalinity drops through heaters at various sampling points had stopped.

Mr. Rogers then decided to find out just how good Calgon was and how much was required to do the job. He set up 15 water heaters in his plant and ran them continuously for two years. Experiments carried out with the assistance of the local Master Plumbers Association over this period of two years at various temperatures and Calgon concentrations showed that a feed of only ½ ppm. of Calgon at the plant was required to insure the people of Wichita against scale formation in their hot water heater coils and pipes.

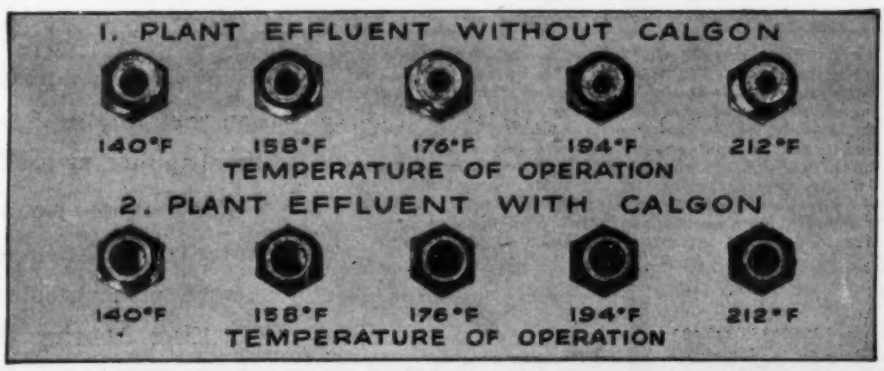
In Wichita, and hundreds of other cities, the effectiveness of Calgon has been proved. Don't take our word for it, or even Mr. Rogers'. Make your own tests on your own water and see for yourself how much can be accomplished in scale prevention and corrosion control with only a small amount of Calgon.

*Calgon is the registered trade-mark of Calgon, Inc., for its glassy sodium phosphate products.



(above)
Hot water heater assembly for experiments which showed that Calgon treatment prevented scale in amounts as low as ¼ ppm.

(below)
Cross sections of test coils show effectiveness of Calgon in preventing scale at various temperatures.
1. Plant effluent without Calgon.
2. Plant effluent with Calgon.



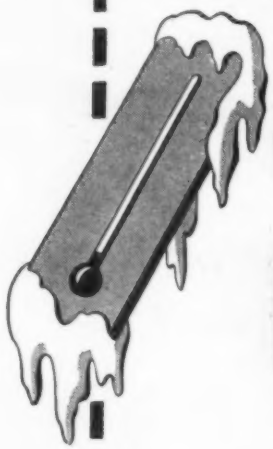
HAGAN
HALL
BUROMIN
CALGON

calgon, inc.

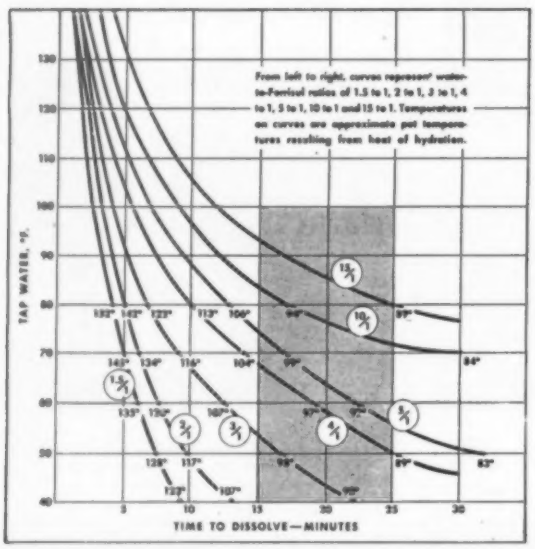
A SUBSIDIARY OF
HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH 30, PA.

SPEEDY FLOC FORMATION AT LOW TEMPERATURES



with FERRISUL


From left to right, curves represent water-to-Ferrisul ratios of 1.5 to 1, 2 to 1, 3 to 1, 4 to 1, 5 to 1, 10 to 1 and 15 to 1. Temperatures on curves are approximate pot temperatures resulting from heat of hydration.
TAP WATER, °F.
TIME TO DISSOLVE—MINUTES

These curves show: (1) what temperature will be produced in the mixing pot by seven different Ferrisul : water ratios as the temperature of the water added varies, and (2) how long it will take Ferrisul to dissolve in each of the seven ratios illustrated as the tap water temperature varies. For best results, it is recommended that Ferrisul : water ratios be changed as the temperature of your tap water changes so that mixing pot temperatures will always remain between 89° and 100°F. (shaded area). In this way, Ferrisul will always be completely dissolved in 15 to 25 minutes. For more details on Ferrisul dissolving and feeding, write for the new, four-page leaflet, "Feeding Data for Ferrisul."

Because the floc forms rapidly the use of Ferrisul has a distinct advantage over other coagulants when the temperature is low.

Impounded supplies which freeze over in winter are unusually cold. Under these circumstances CO_2 builds up, resulting in acidity and a lowering of pH. In such cases ferric salts are much more efficient than other coagulants.

Ferrisul has a maximum efficiency around pH 4.5 to pH 5; therefore a minimum of coagulant and corrective alkali is necessary before filtration.

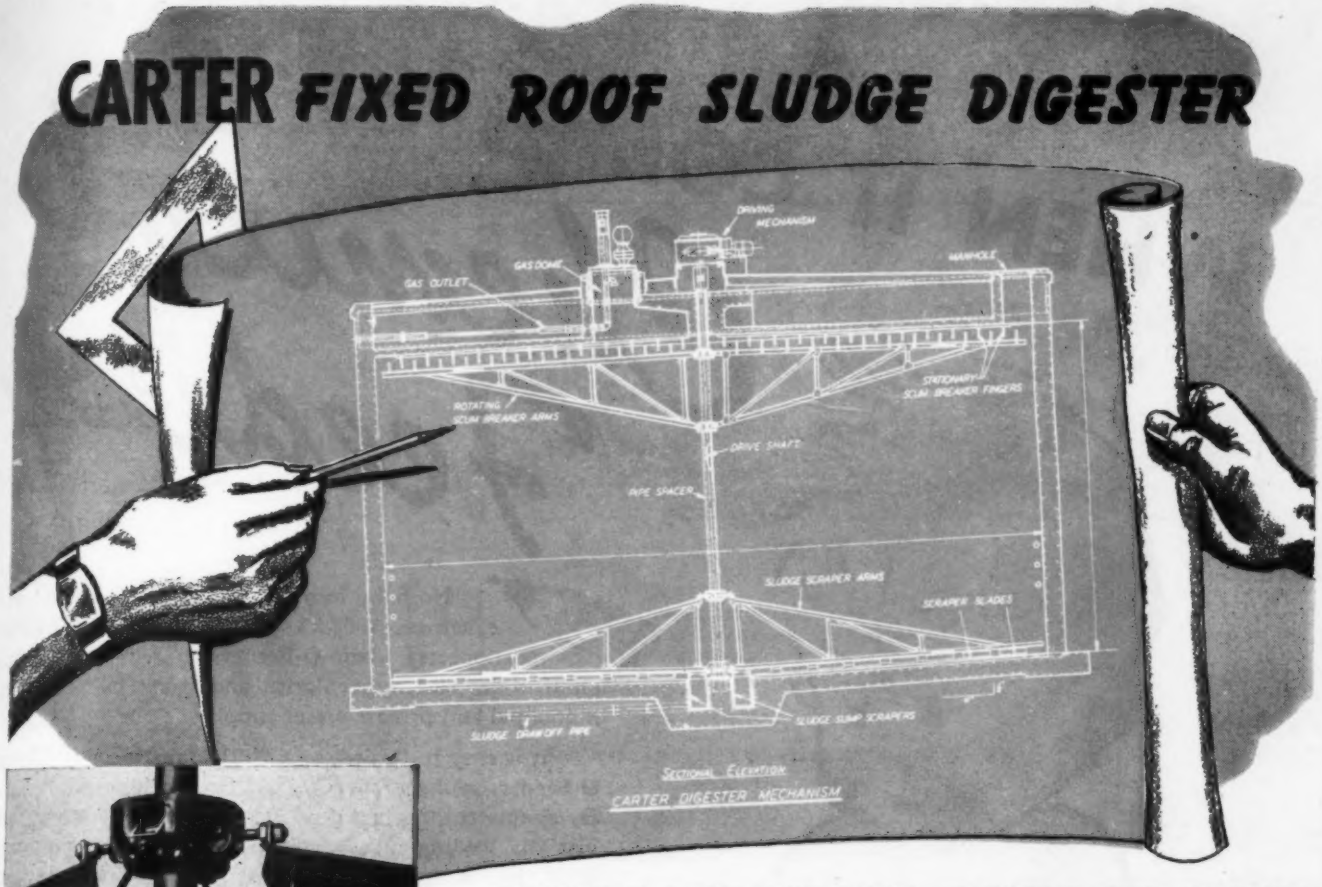
Another cold weather feature of Ferrisul: being the only anhydrous ferric sulfate available for water and sewage treatment, it is the only such coagulant that *creates heat* when mixed with water and therefore the only one that can be completely dissolved in cold water by simply adjusting the ferric sulfate: water ratio. (see chart)

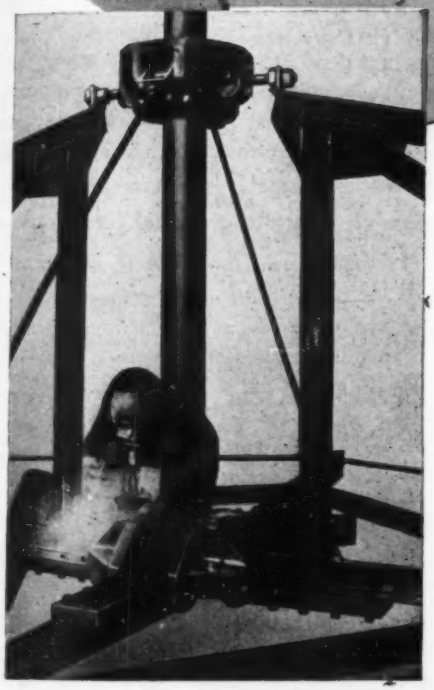
For complete technical information on FERRISUL for water treatment . . . also counsel on all types of water and sewage plant problems, address: Monsanto Chemical Company, Merrimac Division, Everett Station, Boston 49, Massachusetts.

Blueprint Now!

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

CARTER FIXED ROOF SLUDGE DIGESTER





Fabrication of Sludge Scraper Mechanism

- Complete details of the CARTER Fixed Roof Sludge Digester are given in our Bulletin WS-4311. Write for it today.
- Our Engineers are at your command for consultation and advice. No obligation, of course.

RUGGEDLY BUILT, FOR LONG, TROUBLE-FREE SERVICE

Will produce a Thickened Sludge of Uniform Consistency and Low Moisture Content

Its slow, positive stirring action

- Facilitates mixing of green sludge with treated material and speeds the digestion process.
- Removes grit and similar material regularly.
- Prevents sludge accumulations in remote parts of tank.

These Mechanical Advantages insure Positive Action, Long Life and Minimum Maintenance Cost

1. Positive sludge transfer with heavy duty plow blade truss fabricated from standard structural steel shapes.
2. Continuous break-up of all surface scum accumulations by rotating breaker arms intermeshing with fixed arms attached to roof.
3. Adequate electrical and mechanical overload protection.
4. Efficient gas collection in electrically arc welded, hot dipped galvanized steel dome.
5. Drive mechanism comprising triple type reducer and totally enclosed weatherproof gear motor, guaranteed to withstand any emergency shock loads.

CARTER

RALPH B. CARTER COMPANY

Main Office
HACKENSACK, N. J.

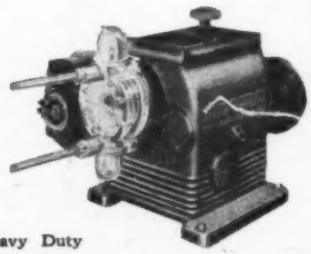
New York Office
53 Park Place, NEW YORK 7

WHEN IT COMES TO - *Chemical Feeding*

No baby formula was ever mixed with the exactness (100%±1½%) that thousands of %Proportioneers% Chem-O-Feeders are regularly feeding alum, soda ash, hypochlorite and other chemicals for municipal and private water supplies.

It is easy to be precise with the Heavy Duty Chem-O-Feeder, youngest member of %Proportioneers% family. By simply turning the feed selection knob you can adjust the feeding rate while the pump is in operation. With the transparent "See-Thru" plastic head, you can observe the movement of the valves and the steady flow of the liquid.

For information on accurate chemical feeding write for Bulletin SAN 2.



%Proportioneers% Heavy Duty Chem-O-Feeder for all chemical feeding up to 7 g.p.h. and 100 p.s.i.g.

% PROPORTIONEERS, INC. %

Chemical Feeder Headquarters

9N CODDING ST., PROVIDENCE, R. I.

WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"Developments of the Year in Water Supply"

Constitutes the customary annual review of developments of the year in the field of water supply and water purification. This year we are fortunate to have as the reviewer the President of the American Water Works Assn. and a very much on his toes operator and observer.

"SAM" NEWKIRK,
Supt. and Engineer of Water,
Elizabeth, N. J.

"Developments of the Year in Sewage"

Is the annual review of developments in the field of sewerage, sewage treatment and industrial wastes treatment to be featured in our February issue, as in the past. Those who have read similar reviews by this year's author will need no further urging not to miss this one. In addition to having attained high recognition in the water works field, he is now the President of the Sewage Works Federation.

ALBERT E. BERRY, Ph. D.,
Chief Engr. of the Ontario Dept. of Health.

Cathodic Protection

Is to our thinking a topic deserving of more study and greater consideration as a corrosion suppression measure of marked potentialities and wide application. Having learned of recent investigations and exact studies of the process in laboratory and field, which confirm or refute earlier conceptions of the process and throw new lights on the potentialities and limitations of this electrolytic anti-corrosion measure, arrangements have been made for a series of articles by a well grounded electrochemical engineer whose practical and research experience with the cathodic processes makes him well qualified to discuss theory, experimental evidence and practice in a highly revealing manner. He is—

LEE P. SUDRABIN, Chief Engr.,
Electro Rust-Proofing Co., Dayton, Ohio.

"Licking a Supernatant Headache"

Is the story of how an ingenious plant operator struggled with the all too common "headache" of plant reports due to the return of supernatant liquor ("sludge soup" some call it) from the sludge digester to the plant influent. Then he reasoned out another way of doing it and this article reveals a highly simple scheme which has resulted in improved digester performance and no supernatant return whatever. The story of how "Speed" did it is told by "Speed's" boss—

VAN K. SHARP,
Sanitary Engineer, Scott Field Ill.

"What is an Oolith?"

If you would know, watch for the forthcoming article on the important subject of biological growths on the interior of water mains. The author discusses the problem of such growths within distribution systems and their effects on water quality and their connection with tuberculation, pitting, red-water or the "black water" of degradation or anaerolosis. Crenothrix is one of the most widely experienced of the trouble makers which thrives in iron, manganese and carbon dioxide. What about these ooliths—well, just read the article for the story of the "marble sarcophagus of the Crenothrix" as interestingly told by

"DOC" CARL WILSON,
Water Quality Consultant, Los Angeles, Cal.

Delayed Meetings Reports

With regrets we find it impossible to print in this issue reports covering the annual meetings of the

California Section of AWWA.
4 States Section of AWWA.
South Dakota Water and Sewage Wks. Conf.

It is planned to print these reports in our January issue, abbreviated to the degree which war restricted white-space dictates.

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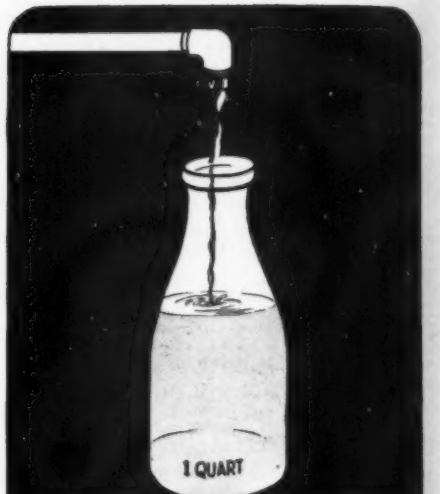

A SUGGESTED WAY OF CHECKING LOW FLOW TEST RATES

One quart (¼ gallon) per minute is the standard low flow test rate for ⅝" meters. An easy way to check it on your test bench is by running it into a quart bottle. If the bottle is filled in less than a minute, the rate is too high.

115

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WATER WORKS & SEWERAGE

VOL. 91, No. 12 *A Gillette Publication* DECEMBER, 1944

WATER SUPPLY VS. WAR DEMANDS IN NORFOLK, VA.

An Account of an Epic Struggle to Keep the All Important Water Supply Front Reinforced During an Unprecedented Demand Blitz Experienced by Norfolk's Water Division

By

NORMAN Z. BALL
Principal Ass't Engineer
Dept. of Public Works

and

R. W. FITZGERALD
Superintendent
Division of Water

NORFOLK, VA.

THE problem which has confronted the Department of Public Works in supplying water during the **past few years** to Norfolk, Va., and the numerous Military establishments within the City and adjacent territory as far east as Fort Story may be seen at a glance by reference to the chart of water use reproduced with this article. This chart shows the average daily pumpage of water for each year since 1898 and the phenomenal demands placed upon the water utility in the present war effort.

During the First World War the military, naval and other demands raised our daily pumpage from six and one half million in 1917 to twelve million in 1919, an increase of approximately 84%. During the 4 years following that war there was the rather surprising decrease of only about 7%. After this the general trend was again upward, except during three years of the depression, so that in 1940 our daily pumpage had climbed to seventeen million. At the present time our average daily pumpage is approximately thirty-seven million gallons per day, an increase of nearly 120% over the four year period. We feel that it is unlikely that there will be any further large increase in our demands for water and of course we anticipate that after the end of the war there will be a decrease. How much this decrease will amount to is anybody's guess, and we are anxious to compare such with the relatively light decrease following World War I.

At the beginning of the First World War the only supply of water available to the City of Norfolk was the Little Creek reservoirs some four or five miles east of the City. These so-called reservoirs were actually salt water marshes which had been dammed many years previously. This supply was probably capable of delivering eight million gallons per day. As the war activities increased the water demands the City negotiated a lease and later purchased the Norfolk Water Company, then owned by Philadelphia interests. The City, of course, took over the distribution mains of this company and its supply properties which consisted of a well field near our Little Creek Reservoirs, a pumping station at that location and also an impounding reservoir of four hundred and forty million gallons capacity, commonly known as North Landing Reservoir, about ten miles southeast of the City's supply. There was a pumping station at this impounding reservoir and a 24 in. wood stave pipe line delivering the water to the company's pumping station and treatment plant. The City connected this 24 in. wood stave line directly into the City's Little Creek reservoirs, thus making a considerably increased supply available.

A Drought, and a Close Call

Then, a very severe drought occurred in 1919 which resulted in every obtainable bit of water being pumped from these reservoirs, booster pumps being necessary to bring the water from the Little Creek reservoir through the canal to Norfolk's Moores Bridges Pumping Station. To tide over this extreme emergency the City obtained permission from the owners of the Dismal Swamp Canal to take water from that canal and Lake Drummond. Accordingly a pumping station was built near Dismal Swamp Canal and a 20 in. cast iron pipe was laid overland to deliver water into the North Landing reservoir from which it was again pumped to Little Creek. Even with this in operation we were almost at the point of using salt water for sanitation and fire purposes when copious rains in January 1920 relieved the shortage.

The Public Works Department had for many years advocated an entirely new source of supply from a drainage area some twenty miles west of Norfolk where water rights had been purchased on both Exchange Creek and Everetts Creek. The fact that we had just barely escaped a complete exhaustion of our water supply roused the City fathers to authorize preparation of plans for this new supply and to appropriate the necessary funds. As a result a dam was constructed across Exchange Creek impounding thirty-seven hundred million gallons on a drainage area of thirty and one tenth square miles. This has since been known as Lake Prince. A pumping station just below the dam was constructed, together with a 30 in. and 36 in. pipe line crossing Everetts Creek, the Nansemond

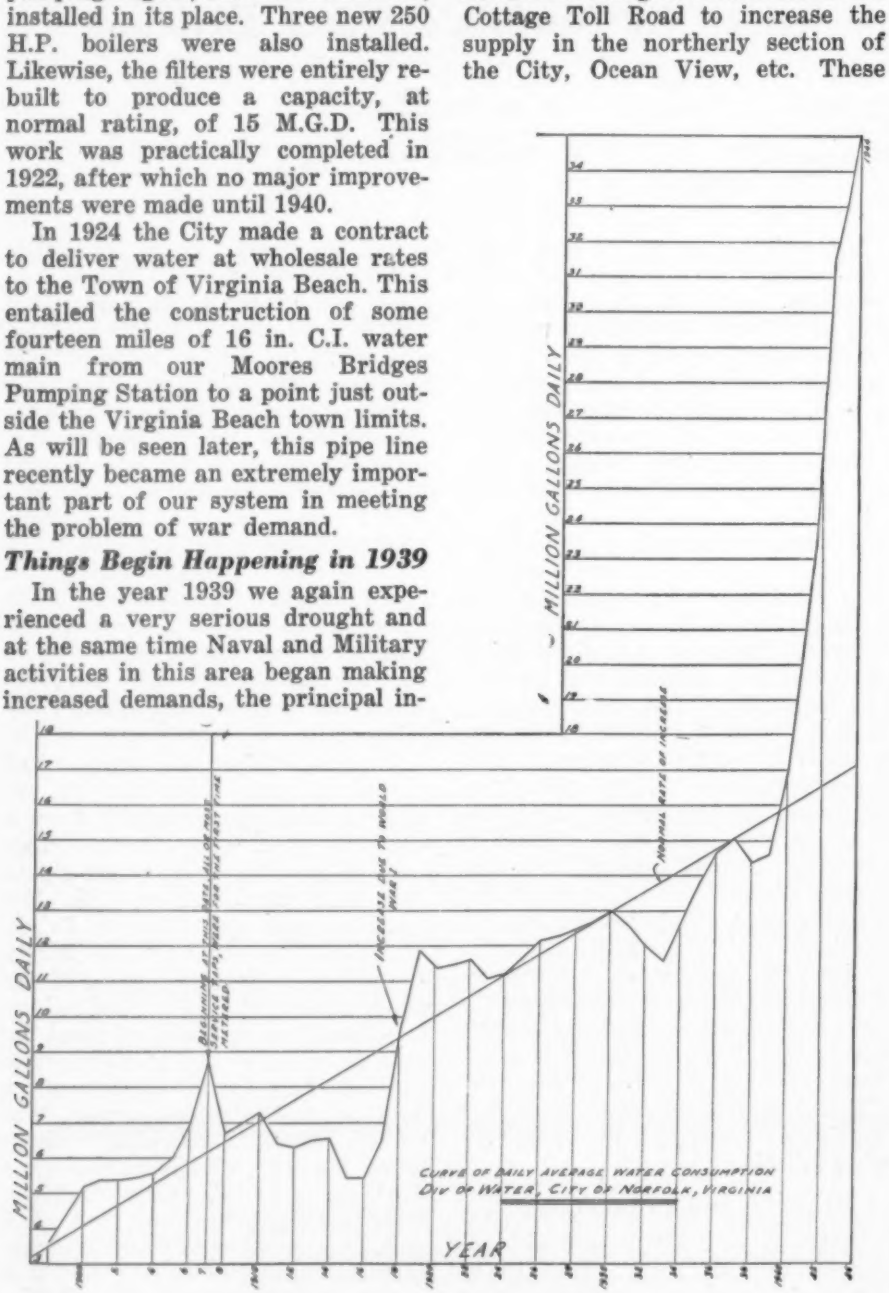
River and the Elizabeth River and entering the westerly side of the City. At this point a filtration plant of a rated capacity of 12 M.G.D. and a pumping station with a 12 M.G.D. cross compound Corliss pumping engine were constructed. This is now known as the Thirty-seventh Street Station. Two electric pumps were later added.

During this same period notable improvements were made at the old Moores Bridges Station, about four miles east of the City. Two motor-driven centrifugals had been installed during the First World War, rated at 6 M.G.D. each, after which a very old Holly engine was removed and a new crank and fly-wheel pumping engine, rated at 15 M.G.D., installed in its place. Three new 250 H.P. boilers were also installed. Likewise, the filters were entirely rebuilt to produce a capacity, at normal rating, of 15 M.G.D. This work was practically completed in 1922, after which no major improvements were made until 1940.

In 1924 the City made a contract to deliver water at wholesale rates to the Town of Virginia Beach. This entailed the construction of some fourteen miles of 16 in. C.I. water main from our Moores Bridges Pumping Station to a point just outside the Virginia Beach town limits. As will be seen later, this pipe line recently became an extremely important part of our system in meeting the problem of war demand.

Things Begin Happening in 1939

In the year 1939 we again experienced a very serious drought and at the same time Naval and Military activities in this area began making increased demands, the principal increase being at the Naval Operating Base of the Fifth Naval District which is located at the extreme northwest corner of the City. In the meantime the old 24 in. wood stave pipe line from North Landing Reservoir had completely failed and therefore our first move in meeting a prospective increased demand was to replace that line with a 30 in. line of concrete pipe together with the installation of two new centrifugal pumps rated at approximately five and a half million gallons each. About the same time the City laid a new 20 in. main from the Thirty-seventh Street Station toward the Naval Operating Base to a point north of the Lafayette River; and a 16 in. line along Cromwell Road and Cottage Toll Road to increase the supply in the northerly section of the City, Ocean View, etc. These three lines cost approximately $136,000.00.


MILLION GALLONS DAILY
MILLION GALLONS DAILY
INCREASE DUE TO WORLD WAR I
NORMAL RATE OF INCREASE
CURVE OF DAILY AVERAGE WATER CONSUMPTION
DIV OF WATER, CITY OF NORFOLK, VIRGINIA
YEAR

Water Pumpage Record—Norfolk, Va.

(Note the minor drop back in consumption following World War I, and the comparative increase in demands resulting from World War I as against World War II)

Later in 1940 the United States Army authorities demanded a supply of water for Fort Story which is a few miles north of Virginia Beach and for Camp Pendleton which is a few miles south of Virginia Beach and accordingly a booster station was built on the Virginia Beach pipe line at Lasking Road from which point mains were laid to Fort Story and Camp Pendleton; and from that time until a few months ago the 16 in. Virginia Beach pipe line was pushed to the limit with still another booster station midway of its length in order to keep water in Virginia Beach, Fort Story and Camp Pendleton.

Then, Pumps and More Pumps, And Filter Plant Improvements

Early in 1941 the City arranged to purchase a new 15 M.G.D. centrifugal pump and to install it at Lake Prince to increase the delivery from that point to Norfolk and also installed flocculators in the coagulation basins at the Thirty-seventh Street Station to make it possible for this filter plant to produce purified water at increased rates. As demands for water were rapidly increasing we hurriedly corralled three second hand pumps and motors and installed them at a point about midway of the length of the Lake Prince force main to serve as a booster station and by that means we were able to raise the delivery of this pipe line from fifteen million to eighteen million gallons per day, all of which was forced through the revamped 12 M.G.D. filter plant without harmful results.

Temporary Pipe Lines and Another Supply Reservoir Hastily Constructed—and More Pumps And Filter Plant Doubled in Size

By this time it was evident that our sources of supply were not equal to the demand and the Navy Department warned us that, whereas they were using one and one half M.G.D. before the War, they were now likely to need 10 M.G.D. The only way of increasing the supply quickly was to again lay a temporary pipe line from the Dismal Swamp Canal, which was done in the latter part of 1941 at a cost of $355,000.00 At the same time the City was as rapidly as possible making plans for a general increase in our facilities and made a contract with the Federal Works Agency to provide a large part of the funds. This general increase in facilities embraced the construction of an-

other storage dam immediately north of Lake Prince on Everett's Creek, which reservoir is now known as Lake Burnt Mills. Also the installation of another 15 M.G.D. pump at the Lake Prince Pumping Station, the laying of a 30 in. and 36 in. force main from Lake Prince to Norfolk and the doubling of the filtration plant at Thirty-seventh Street and a new ten million gallon electric pump at that station was also provided.

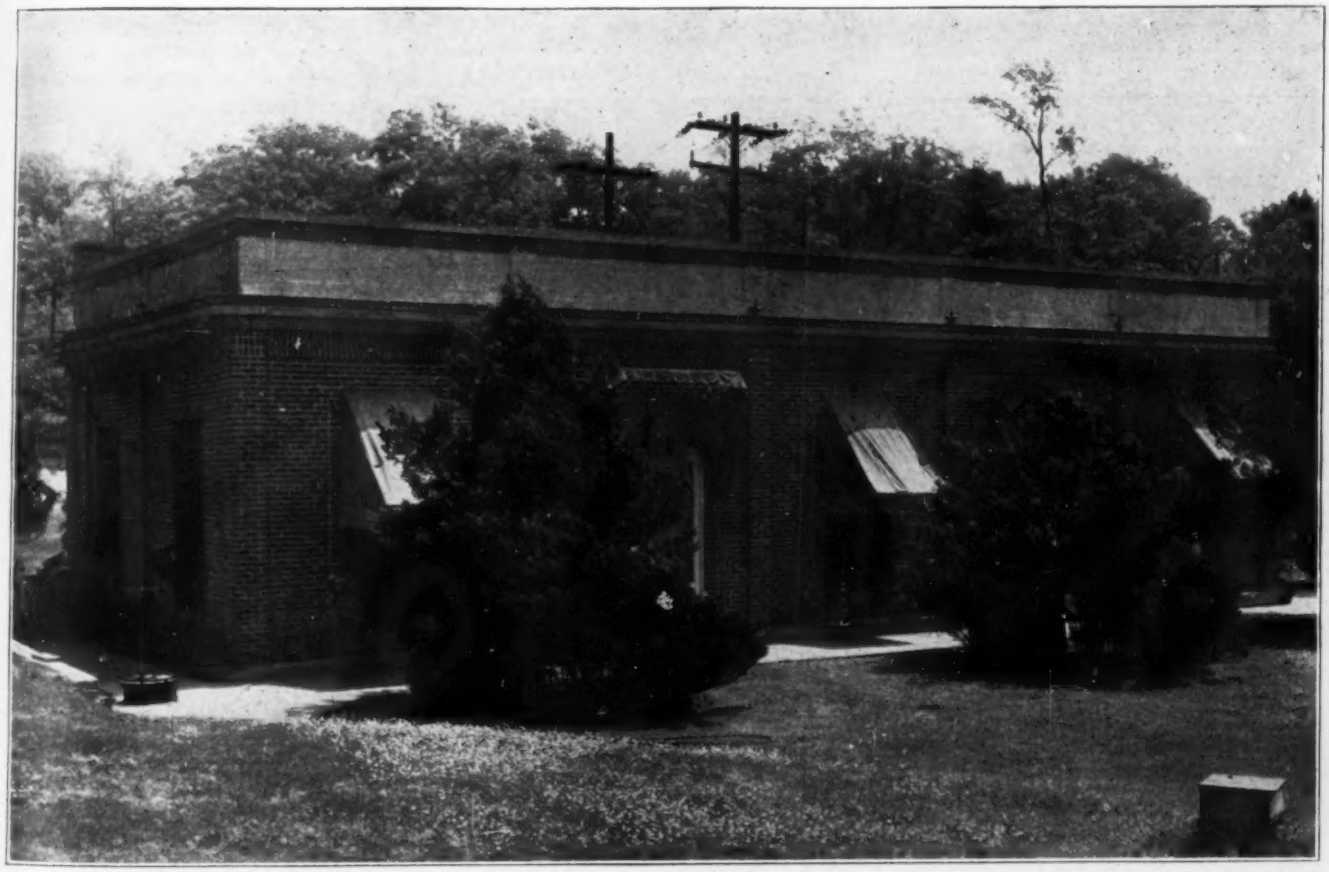
The original filtration plant at Thirty-seventh Street had been so designed that it could be doubled and produce a symmetrical layout of filters and coagulating basins. All of this was estimated to cost $2,250,000.00. The original plant included a tunnel from Lake Burnt Mills to Lake Prince so that water could be transferred from one lake to the other without pumping, but when bids on this tunnel were received they were so high that this part of the work was abandoned. Instead a temporary pumping station was set up at an old mill dam at Lake Burnt Mills and a wood pipe line laid over the divide to deliver water to Lake Prince. After completion of the dam a permanent pumping station was built just below it.

Except for a gap of some two and a half miles in the above mentioned second pipe line, the above work was completed early in 1943 and all put in service as quickly as possible. As stated the filter plant, by that time doubled in size, had a rated capacity of 24 M.G.D. In a very short time it was working at that rate and higher.

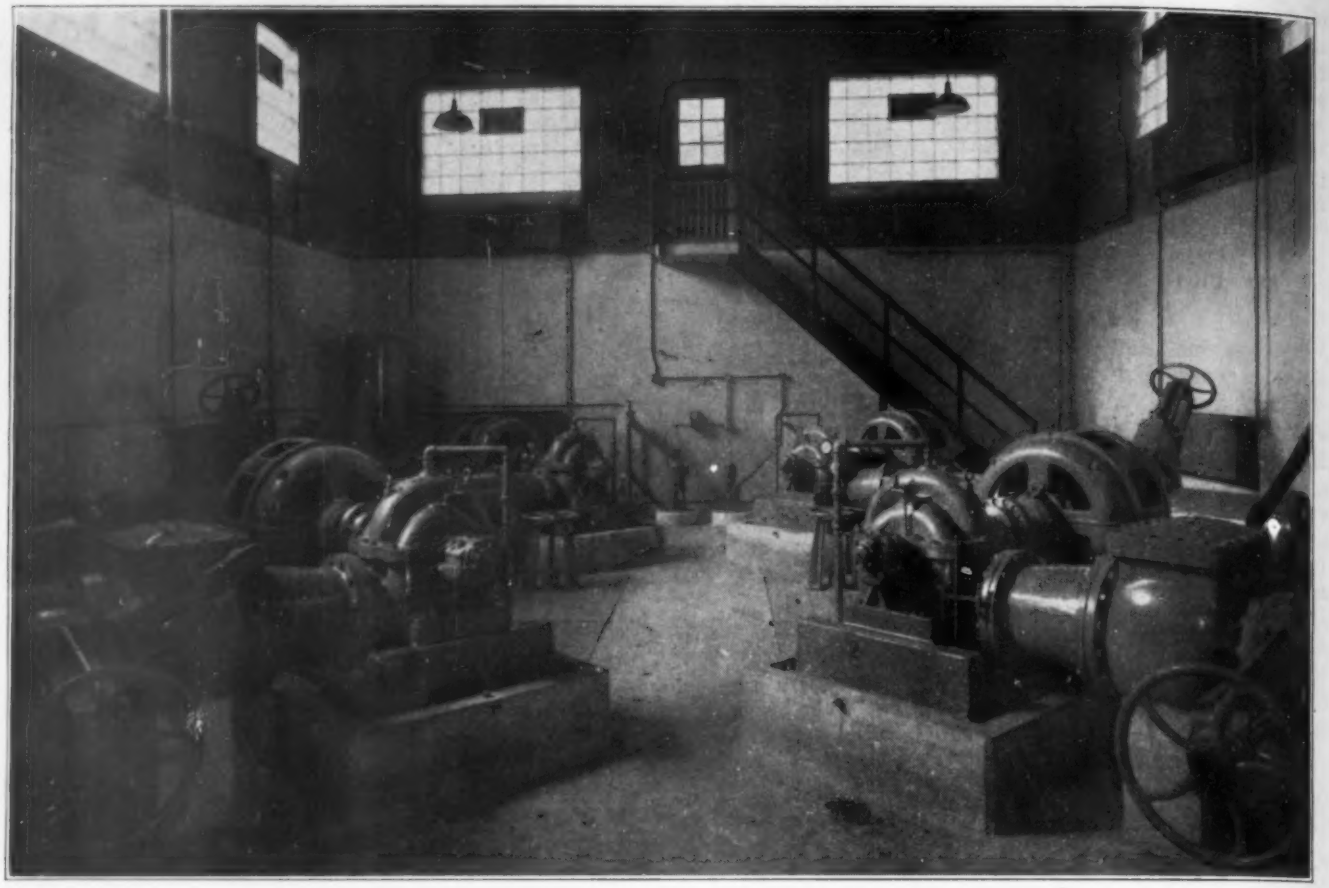
Also during 1942 a 24 in. delivery main was laid from Lafayette River all the way to the Naval Operating Base. A 30 in. concrete main was laid from Moores Bridges Pumping Station some two or three miles northwestwardly to supply additional water to the northern section of the City and a new 15 M.G.D. pump was intsalled at Moores Bridges. These items cost $500,000.00.

Then More Supply from the Distant Blackwater and Nottoway Rivers

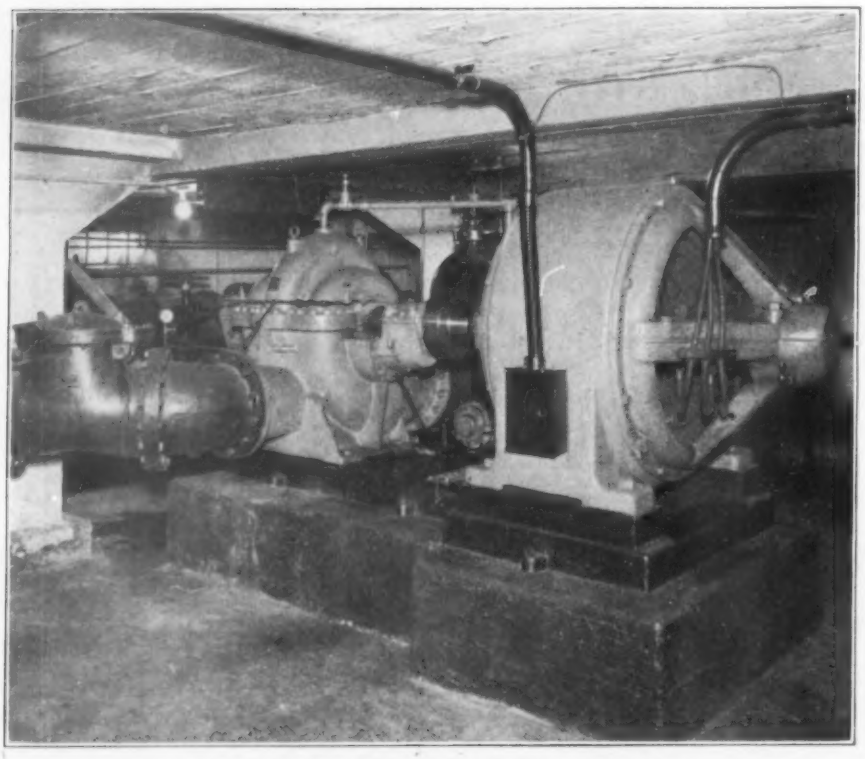
In the meantime, the Federal Works Agency acting entirely independently of the City of Norfolk, had an investigation made, by a well known consulting engineer, of the water situation in the entire Hampton Roads area. This report recommended additional supplies for both Norfolk and Portsmouth as well as Newport News. To furnish this additional supply for Norfolk and Portsmouth the report recommended the construction of pumping stations on both the Blackwater and Nottoway Rivers, together with a 42 in. pipe line from these two pumping stations to the headwaters of a stream entering Norfolk's Lake Prince, and a branch line going similarly to the headwaters of Lake Cahoon which forms a part of the water supply of the City of Portsmouth. This project was constructed, in accordance with the recommendations, by the Federal Works Agency and is still owned by it. The agency has offered to sell the entire project to the City of Norfolk or to sell water to the City of Norfolk. No decision in this matter has as yet been reached but a purchase may eventually be made. As a preliminary to these negotiations we obtained permission to run a sixty days test on one or both of these pumping stations at our own expense and actually pumped nine hundred million gallons from this new source of supply into Lake Prince. We also needed this water because of the fact that we had been unable to store any large quantity of water in Lake Burnt Mills and therefore our sup-



Lake Prince Pumping Station.



The New Blackwater River Station—Norfolk, Va.
(Built by Federal Works Agency under the Lanham Act and with funds appropriated thereunder.)



One of the War Demand Pumps at 37th St. Sta.
(A De Laval 10 m.g.d. pump operating against 167 ft. head. Wound rotor G. E. motor, 1,150 r.p.m., installed by Dravo Corp.)

ply from that source was rather limited.

The Latest Improvements Installed or Underway

Early in this year we made another large improvement contract with the Federal Works Agency covering the following items:

1. A new 20 in. pipe line from Moores Bridges Pumping Station to the Town of Virginia Beach.
2. A 30 in. cross-town distribution main from the Thirty-seventh Street Station to a connection with the 30 in. force main coming into the easterly side of the City from Moores Bridges.
3. Two and one half miles of 36 in. concrete pipe to fill in the remaining gap in the second Lake Prince pipe line from Drivers to the Deans Booster Station.
4. 16 in. pipe to increase the supply to the Little Creek Amphibious Training Base and a 12 in. pipe from that point to increase the supply to Camp Bradford.
5. A 12 in. branch pipe line from the Laskin Road Booster Station

(on the Virginia Beach pipe line) to supply additional water to Camp Pendleton and also to extend southwardly parallel with the Atlantic Coast to the Naval Training Station at Dam Neck.

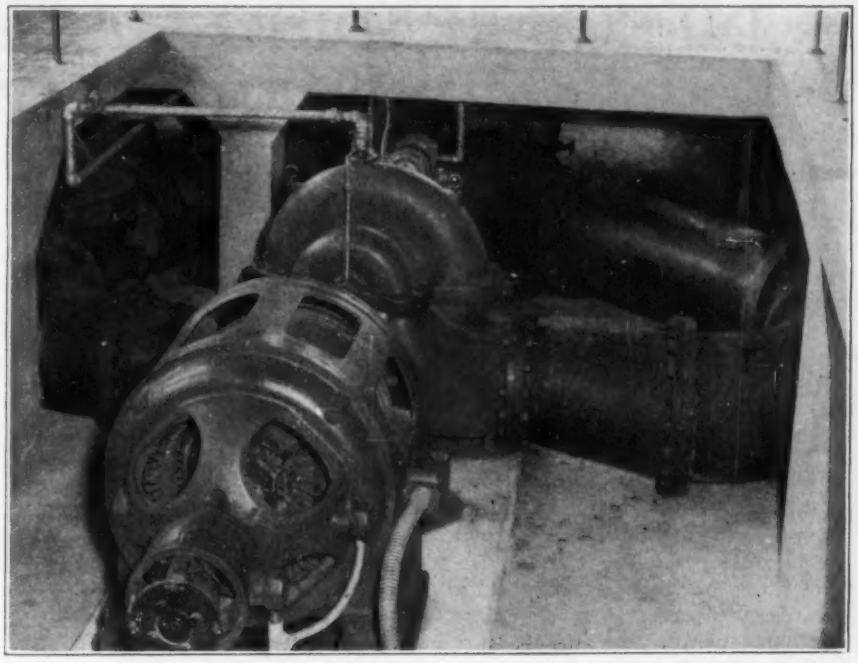
6. A new low lift pumping station at Moores Bridges together with a new intake, chemical house and flocculators in the coagulation basins.

All this was estimated to cost $996,000.00 plus the value of the 30 in. and 36 in. concrete pipe and 20 in. cast iron pipe to be taken up from the temporary Dismal Swamp Canal line.

We had long wanted this 30 in. cross town connecting main; and, of course, the remaining gap in the second Lake Prince pipe line, completed as soon as possible. Therefore in laying the temporary Dismal Swamp Canal line we used the required lengths of 30 in. and 36 in. concrete pipe so it could be used later in these two pipe lines. The remainder of the Dismal Swamp Canal line was made of 20 in. cast iron; and that was taken up and reused in the new line to Virginia Beach. All the above pipe lines have been completed and are now in operation but the work on the low lift pumping station, etc., at Moores Bridges will not be finished for several months.

Some Close Scheduling

As an indication of how narrowly we were able to keep up with increased demands it may be stated that as soon as we discontinued use of the temporary Dismal Swamp Canal pipe line the eight million gallon pump which had been in use there was moved to our Thirty-seventh Street Pumping Station and installed along side of the ten million gallon unit installed a year earlier. This pump was set up on structural steel shapes which were to be enclosed in concrete to complete the foundation; but when the pump was started we had such continuous need for it that it was not shut down a minute for some months even to cast this concrete base. Every serviceable pump in this Thirty-seventh Street Station is in use every day.



A 15 M.G.D. Unit at Moores Bridge Sta.
(De Laval pump and 500 h.p. synchronous motor operating at 1,200 r.p.m. against 165 ft. head.)

And It Adds Up to $4,500,000 Worth of the Following:

Thus, after expenditures totalling nearly four and one half million dollars, we arrive at the present time under these conditions:

We can get an ample supply of water at Lake Prince by pumping over from Lake Burnt Mills and the Nottoway River; but the two 15 M.G.D. pumps at Lake Prince are in operation continuously; the two pipe lines to Norfolk are carrying their full capacity; the filter plant at Thirty-seventh Street is continuously overloaded, and in the adjacent pumping station we have no standby pumps available. At the same time we are drawing more water from the old supply at Moores Bridges than the watersheds of Little Creek and North Landing reservoirs can safely produce. Therefore, we are bending every effort to increase the supply from Lake Prince and to this end we are considering the advisability of again operating the Deans Booster Station to increase the capacity on one of the Lake Prince pipe lines. If there should be any further increase in demand there would be no alternative but the construction of a third pipe line from Lake Prince or Lake Burnt Mills to Norfolk and the construction of a third filtration plant. As stated in the beginning of this article we are now hopeful that no such further increase will occur and that we will be able to meet demands with our present facilities. We are now negotiating for a much needed 15 M.G.D. pump, with steam turbine drive to serve as a stand-by unit at the Thirty-seventh Street Station. In the meantime this station and others are effectively guarded and protected against intrusion.

Straws in the Wind of Blueprint Now!

Director of Streets and Sewers, Arthur C. Myers of St. Louis has recommended extension of one interceptor sewer and ten relief sewers for his city, as a post-war project to cost some $10,000,000. And the Board of Public Works and Sanitation of Indianapolis, Ind., is seeking funds to make a comprehensive survey of the sewerage system with the idea of expanding facilities as necessary. Another incipient post-war plan.

Washington Suburban San. Comm. Wins Award

We haven't heard of any water works receiving an "E" for excellence in production of that most vital war material, "Water for industry as well as health," but down in Washington, D. C., the National Security Award of the United States Office of Civilian Defense was presented in August to the Washington Suburban Sanitary District. Certificates of Efficiency were also awarded to the employes "for devotion to defense activities." We have no doubt that these boys deserved some recognition and are glad to see them receive it. We believe there are quite a few others in both water and sewage plants who also deserve some recognition for service on the home front in this World War II.

DIRECT READING GAGE FOR FIRE HYDRANT FLOW

By A. A. HIRSCH*
State Department of Education
BATON ROUGE, LA.

MEASUREMENT of flow from a fire hydrant is a useful procedure in many ways. Probably the most important application is in evaluation of available fire flows at various sections of a distribution system. Often employed when chlorinating new or repaired mains, a measured withdrawal from a fire plug synchronizes water flow and chlorine feed for uniform mixing. Hydrant flow measurement is also an essential step in the incremental method for determining the C value for a pipe line. When flushing mains through fire hydrants to clear out the distribution system a knowledge of the flow enables an operator to estimate the time required for complete displacement and also to record the amount of water allowed to waste.

Of the several methods in vogue for hydrant flow measurement, namely, the special pitot tube-gage combination, the stream trajectory, the short tube with terminal orifice, and the velocity head reading by means of a pressure gage on a closed cap, the last named is the one most generally employed by reason of its simplicity in principle and equipment.

The Procedure

In determining flow from a fire hydrant by the pressure gage method all that is needed is to connect an accurate gage to the closed nozzle, and discharge the hydrant through the other nozzle. The flowing nozzle may be considered as a "short-tube" and its flow calculated from the usual orifice formula, but using an orifice coefficient of 0.9 instead of the familiar 0.61 which holds for a sharp edged orifice. Thus

$$\text{Flow (cu. ft./sec.)} = C\ A\ V$$

where

C = fire hydrant orifice coefficient
= 0.9

*Director, Sectional School on Water Supply and Sewerage.

The Author

$$A = \text{area of nozzle (sq. ft.)} = 0.785 \times \frac{\text{Diameter}^2_{\text{(inches)}}}{144} = 0.00545\ \text{Diameter}^2_{\text{(inches)}}$$

$$V = \sqrt{2\,g\,h_{\text{ft. water}}} = \sqrt{2 \times 32.16 \times 2.31 \times \text{Pressure}_{\text{psi.}}}$$, the pressure reading being taken off the closed nozzle

$$= 12.2\sqrt{\text{Pressure}_{\text{psi.}}}$$

Substituting in the first equation:

$$\text{Flow (gpm.)} = \frac{7.48 \times 60 \times 0.9 \times 0.00545}{\text{Diameter}^2 \times 12.2\sqrt{\text{Pressure}_{\text{psi.}}}}$$

$$= 27\ \text{Diameter}^2_{\text{inches}}\sqrt{\text{Pressure}_{\text{psi.}}}$$

This is the familiar form commonly used to calculate the discharge from a fire hydrant.

Ordinarily the 2½ inch nozzle is used, as the 4 or 4½ inch nozzles do not conform with accuracy to a simple formula. Substituting the value of 2½ inches for the diameter in the above formula, there results

$$\text{Flow (gpm. through 2½ in. nozzle)} = 27 \times 2.5^2 \times \sqrt{\text{Pressure}_{\text{psi.}}} = 168.7\sqrt{\text{Pressure}_{\text{psi.}}}$$

from which the discharge through a 2½ inch hydrant nozzle may be conveniently calculated.

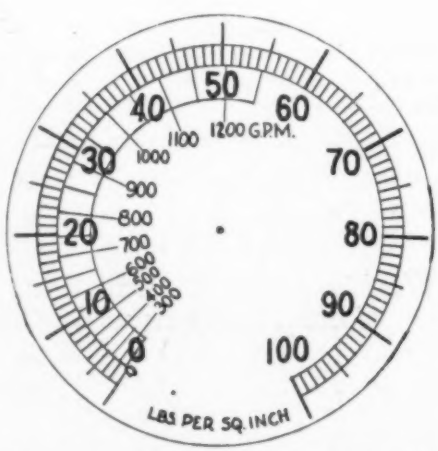


Figure 1.—Dial of pressure gage calibrated to read directly fire hydrant flow from a 2½-in. nozzle

The Self-Calculating Gage

Inasmuch as a given velocity head on the pressure gage corresponds to a fixed discharge the gage may be calibrated to read this flow directly and thereby obviate the need for calculation. A dial so calibrated is illustrated in Fig. 1. By marking off a dial in this manner, the gage may be used in hydrant flow studies to facilitate discharge adjustments and to enable flow evaluation on the spot without calculations or conversions. Figure 1 may also be used as an approximate solution to the hydrant formula for a 2½ inch nozzle rather than perform the numerical substitutions.

The accuracy of the pressure gage should be checked on a cold test apparatus, especially in the low pressure range below 500 gpm. where slight inaccuracy causes relatively large errors in the indicated discharge. If the test gage is off the needle position may be reset, the linkage between hollow spring and sector adjusted as required, or a calibration curve drawn to show the true pressure corresponding to any gage reading. From Fig. 1 it will be noted that below a flow of about 250 gpm. the type of pressure gage as illustrated is inapplicable since it fails to deflect.

For flows below this lower limit the discharge is measured by such methods as (1) large water meter, (2) the time required to fill a barrel through a short section of hose, (3) a more sensitive gage or manometer, (4) a special hydrant nozzle with terminal sharp edged orifice, or (5) measuring the offset distance from the barrel to a point where the stream has dropped one foot and referring to a calibration curve.

SOUTHWEST SECTION MEETING IN AUSTIN SETS NEW RECORD

AUSTIN, Texas, was the host City to the Southwest Section of A.W.W.A. which held its 33rd Annual Meeting there Oct. 17-19. More accurately stated, the Austin meeting was the 33rd for the Southwest group which before becoming a Section of A.W.W.A. was the Southwest Water Works Assn.

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Pres., Bexar Water Co.
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(Incoming)
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Supt. Filtr.
Fort Smith, Ark.

In spite of present transportation difficulties a new record in meeting attendance was established, which record of 575 registered members and guests considerably topped the previous record established before the war in 1939. What constituted another record was the large and consistent attendance at the technical sessions, truly a compliment to the quality of the technical program developed by Albert R. Davis, Supt. of Water at Austin, as General Chairman, and Wm. Ehlers, Chief Engr., Texas Dept. of Health, as Chairman of the Program Committee.

Inspection Trips and Entertainment

The weather was superb and one afternoon was devoted to trips of inspection to the dams of the Lower Colorado River Authority, to the Softening and Filtration Plant and Pumping Station of the Austin Water Dept. and to the relatively new Sewage Treatment Plant which employs the activited sludge process and appeared to be in its best behavior for the visitors, as well as spotless in appearance.

Following these inspections, a Texas Barbecue was given by the Austin Water Dept. at Zilken Springs Park and after the repast an old-time Texas dance was held in the park pavilion with music by the Old Time Ranchers from Gonzales (pictured with this report) which orchestra is led by E. Y. McVeigh, Supt. of Water at Gonzales. "An' hit war purty smart fiddlin' them boys did, too!"

Lots of fun was had also at the "Gay Nineties Party" where the ballroom was converted into an old-time beer hall. A buffet supper was served and a floor show and dancing followed. Then on the closing evening came the big Annual Dinner given by the Water and Sewage Works Mfrs.' Assn.

The ladies had a wonderful time attending such things as a "Texas Coffee" (instead of a Tea), luncheon at the native Mexical El Charro, with its delectable food and enchanting music of Old Mexico. Then there was the usual Bridge Party and sight-seeing.

Amiss Receives Fuller Award

The Southwest Section made an extremely popular choice when it voted the George W. Fuller Award for 1944 to Thos. L. Amiss, Supt. of Water and Sewage at Shreveport, La., a past-president of the Section which he is now serving as National Director on the A.W.W.A. Board.

Honored

Thos. L. Amiss
Supt. Water & Sewage
Shreveport, La.

Director Elect

Albert R. Davis
Supt. Water
Austin, Tex.

Trustee

G. L. Fugate
Chief Engr.
Water Div.
Houston, Tex.

The citation with the award called attention to Mr. Amiss' long tenure as a successful water works manager and his continuing interests in and work in behalf of the S.W. Section and the Association. The citation was lengthy and glowing but, in brief, we would say that the award was given to an "All around water works man" in which his community can take just pride and much satisfaction. The award was fittingly announced at the Annual Dinner.

Secy.-Treas.

Geo. J. Rohan
Supt.
Water Comm.
Waco, Tex.

Vice Chm'n

Marvin Turner
Design Engr.
Water Dept.
Austin, Tex.

Officers Elected

The following officers were either elected or continued for the year ensuing:

Chairman: A. H. Ullrich, Supt. Filtration, Fort Smith, Ark.

Vice-Chairman: Marvin C. Turner, Design Engr., Water Dept., Austin, Tex.

Secy-Treas.: Geo. J. Rohan, Supt. of Water, Waco, Tex.

Trustees: M. H. Phillips, Supt. Paragould, Ark., R. O. Williams, Supt. Foss, Okla., H. W. Blakeman, Supt., Rayville, La., G. L. Fugate, Chief Design Engr., Div. of Water, Houston, Tex.

*Nat'l Director (Elect.)**: Albert R. Davis, Supt. of Water, Austin, Tex.

Newkirk and Jordan Luncheon Speakers

Both Sam Newkirk, President, and Harry Jordan, Secretary of A.W.W.A. were in attendance and spoke during the luncheons on succeeding days.

President Newkirk, in taking particular notice of the rate of membership gains by the S.W. Section,

*To succeed T. L. Amiss beginning with the close of the 1945 Convention of AWWA, May 7-11 in St. Louis, Mo.

praised those responsible for bringing the Section up to the position of having to get but two more members to tie the "score" with his New Jersey group for 4th place in Section membership. Mr. Newkirk then went on to recount A.W.W.A. activities, amongst which he mentioned the recent efforts in Washington with the Federal Communications Commission to secure wave band allocations for water utilities exclusively, rather than being required to utilize wave bands of other municipal departments. He spoke of the efforts of AWWA to have the new U. S. Public Health Service Standards for Drinking Water revised in the direction of making these standards subject to practical application in distinction to their idealistic nature in certain portions. Another Washington effort was in connection with Contract Renegotiation as it affects or may affect water utilities. A new committee has been set up to deal with the broad problem of Water Shed Control—an important consideration in the future of public water supplies and post-war activities. The work of the committee will cover erosion control measures, reforestation, recreational uses, the pollution and use or regulation of water supply streams. Mr. Newkirk also reviewed hastily the work of the Committee on Water and Sewage Works Development and what has been attained so far in developing increasing interest in water works and sewerage betterments in post-war programs for making jobs and securing permanent improvements.

"The Status of Water Works Man in His Community" was the subject of one of those snappy and invigorating impromptu talks by Harry Jordan who was in his best form at the Austin meeting. In a straight-from-the-shoulder manner he brought the average water works man to task for hiding his light under a basket of reticence. Advancement in the community and the profession is thwarted by the man who has no wish to be known by his accomplishments. He should make the effort to do a good job with the utility and then go in for publicizing the accomplishments of the utility as far as possible. Reticence to do this is the most costly mistake made by far too many water utility heads. The other mistake is the lack of attention to public-relations generally, his oversight in not working through the public schools and every possible local civic organization.

Presiding Officers

A. S. Hatch, Supt., Div. of Water, Houston, Tex.

V. M. Ehlers, Chief Engr., State Dept. Health, Austin, Tex.

Uel Stephens, Supt., Dept. Water & Sew., Ft. Worth, Tex.

In attempting specifications which the successful water utility manager must meet to gain deserved standing and appreciation in his community, Harry Jordan said that he must cultivate leadership and salesmanship as well as technical proficiency or business acumen. He must learn to express himself in public—and, this doesn't require oratorical ability in the least. All of these things require first that he be, by nature, a public-spirited citizen.

In speaking of operator licensing Mr. Jordan said that it should help advance the status of the water works man but didn't go far enough in the direction of getting over the political hurdles in municipal operation. Mr. Jordan thought that too little had been done generally in the direction of security for the water works man—too few Pension Plans set up when considering that public employees do not benefit from the Federal Social Security Plan.

In pointing out the value of having municipal utilities operate within the jurisdiction of State Public Service Commissions for the good of all concerned, Mr. Jordan felt that it would be of great benefit if there might be what he termed a Division of State Water Works Engineers, which would extend the good job of the State Sanitary Engineers beyond the category of public health and include management supervision as well as safety and adequacy of supply.

As far as AWWA is concerned in advancing the profession of water works operation, standardization of materials, equipment and practices is of course a contribution of considerable value in which the water works man can and should participate. Then if AWWA can develop in every water works operation a realization of greater responsibility and an urge for community leadership with what it takes to attain that important goal in raising his status, that would represent the finest accomplishment of all.

[Incidentally the hour was late, but we didn't see anyone leaving the room before Harry Jordan finished his talk on "What Ails the Average Water Works Super."]

Technical Sessions

The Technical Sessions were preceded by an interesting review by Mayor Tom Miller of water supply history of Austin, from the days when water sold on the street at $1.00 per barrel, through years of private ownership to present-day municipal operation, and what is planned in the nature of betterments following the war.

The Austin Water Department was then described by Albert R. Davis, Sup't, as being a division of the Dept. of Public Utilities which operates the electric plant and the sewage treatment plant in conjunction with the water works and sewage disposal costs are paid with water works income. Austin's first dam in the Colorado (1893) was lost by flood and rebuilt 15 years later. The softening and filtration plant was completed in 1925 with capacity since increased to 18 mgd. The $500,000 activated sludge sewage plant was completed in 1936. In 1928 Austin set up a 25-yr. plan for water works expansion and already this plan is up 9 years ahead of contemplated schedules.

Marvin C. Turner, Design Engineer, the Water Dept. took up the more detailed description, stating

Two Views of Austin's Sewage Treatment Works and Three of the Exhibitors' Booths.

that all design and construction was conducted by the Dept. of Utilities. The policy of the Water Dept. is to give county-wide distribution of wholesome softened water at no loss to the city. Already there are two Water Supply Districts operating in the county which receive water at wholesale rates for distribution. These systems built by the District under Austin Water Dept. approval are subject to purchase by Austin at its option, as covered by contract. One of these is about to be bought in at present and the proposition has been a good one for all concerned.

It will not be possible to report many of the descriptive details of Mr. Turner's paper but he reported that mains are laid inside of the curb-line (South and West) under 2½-ft. cover. For 22 years the Dept. has standardized in a single design of hydrants and valves. Pitometer survey is continuous with the 9 districts covered during each year by a regular crew. This program of conservation and insured fire flow has paid handsomely. All hydrants are inspected and checked for operation and flow yearly. All valves are operated yearly. On the system 4 miles from the pump station is a 10 mg. storage tank and proposed is a duplicate reservoir for the opposite side of town in the post-war plan.

B. G. Cole, Supervisor of Purification, described the Austin Softening Plant and its operation. Impounding dams above Austin make for a relatively uniform raw water. The plant is equipped with rapid mix and flocculators. Anthrafilt has replaced sand in the filters of 18 mgd. capacity. The prechlorinated lime and iron treated water flows through Dorr clarifiers and a secondary basin in sequence. The sludge in the primary clarifier is aerated at 8-hour intervals through a series of perforated pipes. Lime dosage of 5.2 gpg. and sulphate of iron at 0.26 gpg. reduces average hardness of 180 ppm. to between 75 and 80 parts. The prechlorine dosage of 1.3 ppm. is split between the raw water and the water passing from the primary clarifiers to the secondary basins. Ammonia is added at or about the same point as the second chlorine dosage. A residual of 0.8 ppm. chlorine as chloramine is maintained in the finshed water without consumer complaint. Because of improved economy in filter washing Anthrafilt has come up to expectations. This 18 mgd. plant has during 1944 been producing at a 21 mgd. rate to supply peak daily demands without difficulty or water quality impairment. An Enslow Stability Indicator is employed for checking stability of the treated water.

Pittsbg. Meter Reps.
Harvey Hurley (Corpus Christi)
George H. Gleason Mgr. Meter Sales (Pittsburgh)
Ross Burns (Chicago)

Old Time Ranchers of Gonzales
Ranch orchestra organized and led by E. Y. McVeigh, Supt. of Water at Gonzales, Tex. (on left).

Couple of Good Eggs
Fred Stuart, Pres. Stuart-Brumley Corp. Baltimore, Md. and Sam C. Clark, Ch. Engr. Sherman Mach. Wks. Oklahoma City, Okla.

A Session on Distribution

Uel Stephens, Sup't, Fort Worth, Tex., Presiding
(Reported by W. A. Mayhan, Little Rock, Ark.)

Water Meters—by Robert A. Steele, Meter Foreman, Central Power and Light Co., Corpus Christi, Tex.

Mr. Steele, in outlining the procedure followed at Corpus Christi in maintenance of meters, stressed the importance of having by-pass lines on all large meter installations, for fire protection, and the use of Dresser couplings to aid in changing such meters. Before the war, he stated, it was their practice to go over all meters in the system, at stated intervals. Mr. Steele urged that meter shops and meter testing equipment be kept up-to-date, since after all this department is the "cash register guardian" of any water system. In closing he said that the licensing of meter shop employees was just as important, to his mind, as the licensing of other water-works operators and urged that this be given consideration in the future.

Maps and Records—by Wm. W. Brush, Editor of Water Works Engineering, New York City.

This paper was read by Mr. Born of the Texas State Health Department, in the absence of Mr. Brush, whose paper stressed the fact that distribution systems should be planned well ahead of actual construction and that all maps and records should be kept up to date afterwards. He brought out the fact that it was especially important to keep accurate field records showing the location and depth of all valves, from reference lines to permanent landmarks, location of mains, depth of cover, weight and size of pipe, and type of pipe.

Mr. Brush advocated the use of the AWWA Committee Report on water main practice, for use in intelligently planning and maintaining distribution systems. He recommended the use of a bound book for records of services, instead of service cards, bringing out the usually neglected fact that it is easier to lose or misplace a card than a book.

For emergency work, the writer recommended the preparation of a special shut-off map, to be carried by all repair and emergency crews, showing the location of all valves, from permanent, above-ground, landmarks. A pertinent fact stressed, was that such maps

Mr. and Mrs. Marvin Turner Austin, Tex.

Mr. and Mrs. E. F. Byerly West Helena, Ark.

Group of Ladies at the Barbecue

Mr. and Mrs. Lawrence K. Cecil Tulsa, Okla.

Mr. and Mrs. Stewart A. Newland Lubbock, Tex.

Programmers

R. G. Kincaid, Burns & McDonnell, Engrs., Kansas City — *M. P. Hatcher, Dir. of Water, Kansas City* — *Col. H. W. Keller, U. S. Engrs. 8th Serv. Com., Dallas* — *A. M. Brenneke, Engr., State Dept. of Health, Dennison, Tex.* — *Prof. O. M. Smith, Okla. A. & M. Stillwater, Okla.*

should not be more extensive than necessary.

Distribution System Analysis by the Hardy-Cross Method—by Melvin P. Hatcher, Director of Utilities, Kansas City, Mo.

Mr. Hatcher spoke chiefly on the benefit received by the Kansas City system, from the use of the Hardy-Cross Method for evaluating flows to various points on the distribution system. All work on this system (using the Hardy-Cross Method) required 1840 man-hours and cost $5,000. Before applying this method it was estimated that the needed mains would cost approximately seven and one-quarter million dollars. By use of the Hardy-Cross Method of system analysis, the same results were obtained for an outlay of only two million dollars. Mr. Hatcher brought out the fact that system improvements in the larger cities are usually done in accordance with the Fire Underwriters recommendations, which recommendations cover present system needs only and not future requirements. By the Hardy-Cross Method, both present and future distribution system needs can be forecast. This paper emphasized that the scope and usefulness of the Hardy-Cross Method of analyzing distribution systems is too little known to the average waterworks man and that, to many, it seems rather formidable in application. To get the best results the analysis should be carried on from year to year. The tools required for this work are few, the main requirement being that of installing fixed pitometer stations and permanent pressure gage stations. In applying this method advantage should be taken of the several simplified modifications of the original method of Prof. Cross. Notable among these is that of D. R. Taylor, former Supt. of Water at Roanoke, Va., published in the 1943 Reference and Data Issue of WATER WORKS AND SEWERAGE.

Mr. Hatcher's paper was discussed first by **Mr. Russell Kincaid** of the Burns & McDonnell Eng. Co. of Kansas City, Mo. His remarks were confined chiefly to the application of the Hardy-Cross method to Kansas City. The various technical details of carrying out this work were described and slides were shown illustrating the four main studies which were made together with one fire flow study. In this particular work, the maximum hourly demands on the system, up to the year 1965, were determined, and the improvements made on this basis. Mr. Kincaid related several interesting facts concerning the Kansas City system analysis. One of these was that the capacity of one of the city's reservoirs was doubled merely by the installation of 3,000 feet of 16" pipe. In Mr. Kincaid's opinion the Hardy-Cross method is a useful tool to use in complicated distribution systems for diagnosing the system's ills, and indicating the best way in which they can be corrected. Also it serves to determine the strategic location for tanks or storage reservoirs on distribution systems.

A scheduled discussion of Mr. Hatcher's paper by **Mr. E. Shaw Cole**, Chief Engineer of the Pitometer Co., New York City, was read by Mr. Cyrus Bird of the same company. Mr. Bird stated the major work of the Pitometer Co. consisted of making pitometer surveys rather than Hardy-Cross analyses. He mentioned the fact that during the past several years, pitometer surveys had been made in practically all of the larger cities in the United States. These included Cincinnati, Newark, St. Paul, Toledo, Minneapolis, New Orleans and many others. In Texas, he said that surveys had been made in Austin, Dallas, Houston, Waco, Galveston and other cities. In closing, he emphasized the fact that, in work of this type, long-time studies were necessary to secure the best results.

The three papers on the use of the Hardy-Cross method of distribution system analysis aroused a very lively discussion. In answer to a question by Mr. Aldrich of Houston as to whether the average water-works man feels that this method is too complicated to use for the good involved, Mr. Hatcher replied that only the initial study was difficult and that the work became easier as it progressed. He remarked that as more people used it, it would eventually become commonplace. Mr. Kincaid said that the hardest part of the work was to find where the water is used. After this, the work becomes routine. Mr. W. D. Masterson of Houston wanted to know if departmental information as to pressures, etc., could be used in applying the Hardy-Cross analysis. Mr. Hatcher replied that if records were available, they could be used to check the Hardy-Cross analysis.

In answer to a question by Mr. Linn Enslow as to the advantage of

J. Montgomery, Cons. Engr., Austin, Tex. — *R. H. Weiss, Engr., State Dept. Health, Kerrville, Tex.* — *H. S. Peterson ("Pete"), Hayes Mfg. Co., Erie, Pa.* — *"Dave" Morey, Cons. Engr., Dallas, Tex.* — *T. E. Lundy, Joe Ward Engrs., Wichita Falls, Tex.* — *F. V. Sohle ("Vic"), R. D. Wood Co., Dallas, Tex.* — *C. A. Scott, Mgr. Sales, Am. Well Wks., Aurora, Ill.*

the Hardy-Cross analysis over the Pitometer survey, Mr. Hatcher answered by saying that, while the Pitometer survey would reveal the weak points in a distribution system, it would not show the improvement needed to correct them. The Hardy-Cross analysis would do both.

The question was raised as to which of the Hardy-Cross methods or modifications was the easiest to use, to which Mr. Hatcher replied that the simplified network system reduced the work required. In answer to a question as to the smallest size main that could be used in plotting the network, Mr. Kincaid said that normally the smallest mains considered were 8-inch or larger, remarking that in the Kansas City analysis, no main under 12-inch was considered. He also mentioned the fact that in cities of populations between 15,000 and 25,000, the distribution system requirements were usually determined by fire flow requirements.

Electrolysis and Cathodic Protection—by Starr Thayer, Consulting Engineer, Houston, Tex.

Mr. Thayer began his paper by stating that electrolysis was actually man-made corrosion. Since all corrosion is electrolytic in nature, it is reasonable that it can be prevented by some form of cathodic protection. It seems that this method prevents corrosion from the outside of pipe lines rather than from the inside, that is, it protects against soil corrosion. There are many methods by which pipes can be protected from soil corrosion, but the main methods of preventing corrosion consisted of—

(a) Protective Coatings.
(b) Cathodic Protection.
(c) Combination of both.

Simply speaking, cathodic protection consists of applying a small amount of electric current to a pipe to make the current flow from the soil into the pipe, rather than from the pipe to the soil. The strength of current usually required is about 0.3 of a volt. Although the amount of current required depends upon a number of things, such as the number of joints in a pipe, the length of the pipe, etc., 0.3 milli-amps is usually ample. This method of preventing corrosion was begun in the winter of 1931. At the present time there are thousands of such installations. In the 1931 instance, a gas line was to be protected. This line had given considerable trouble from corrosion for three years. Since applying cathodic protection there have been few leaks due to corrosive activity since 1932.

This method works equally well on well casings, water tanks, and other structures carrying water either above or below the ground.

This paper was widely discussed. In answer to a question as to how to determine the efficacy of the process, Mr. Thayer replied that this can be determined by ascertaining the potential of the pipe line at various points. He stated that experience was very necessary in installations of this kind. Mr. Baldwin of Houston, Texas, asked if the outside of a tank would be protected as well as the inside by this method. Mr. Thayer stated that protection was attained only where water touched the metal. In answer to questions Mr. Thayer stated the efficacy of this treatment could be determined by using a potentiometer and that there must be a flow of current to some degree if the method was to work.

In answer to a question concerning the use of this method on well casings, it was brought out that well casings can be protected from the outside only.

Mr. Enslow asked if the formation of the characteristic gray deposit usually seen when this method is used on water tanks was an indication that the method was working. Mr. Thayer stated that this was correct, these spots consisting of calcium carbonate for the most part.

Programmers

Robt. A. Steel, Meter Shop Supt., Cen. Power Co., Corpus Christi, Tex.

M. C. Schwartz, Assoc. Director, Eng. Expt. Sta., L. S. U., Baton Rouge, La.

Maj. R. M. Dixon, U. S. Engrs., 8th Serv. Comm., Dallas, Tex.

B. G. Cole, Filtration Supt., Austin, Tex.

J. M. Van Gelder ("Van"), Sales Engr., W. & T. Co., Dallas, Tex.

Water Supply Sources and Legislation

A Study of Southwestern Streams—by Trigg Twichell, U. S. Geological Survey, Austin, Tex.

Mr. Twichell began his paper with some historical data, citing the fact that in 97 A.D. water was apparently used in Rome at the rate of 38 gallons per capita. Before 1900 little use was made of water facilities in the Southwest. He listed some of the larger dams in Texas, mentioning the Dennison Dam which impounds 5 million acre feet of water, and the Colorado River dams which impound 3 million acre feet of water. With 400,000 square miles in the four Southwest States of Okla., Texas, Ark.

W. A. Mayhan, Supt., Filtration, Little Rock, La.

H. R. Powers, V. P., Flexible Pipe Cleaning Co., Beaumont, Tex.

W. E. Pebworth ("Bill"), S. W. Mgr., Hersey Meters, Dallas

A. B. Cole, Supt., Water and Sewerage, Midland, Tex.

Erle Sherman, President, Sherman Machine Wks. & Fdy., Okla. City, Okla.

Geo. H. Gleason, Mgr., Meter Sales, Pittsburgh Meter Co., Pittsburgh, Pa.

Harry R. Crane, President, Flexible Pipe Cleaning Co., Los Angeles

and La., this region serves 13 million people, and has a rainfall varying from 8" to 60".

The Southwest is amply supplied with water, there being many large streams in this area. The Rio Grande River being listed as the major stream in this section, with next the Arkansas followed by the Neosho, White, Red, and many smaller streams. Mr. Twichell closed his paper by stating that flood control was needed in all of the four states, remarking that future industry development would require hydro electric plant construction.

The Potentials of Underground Water Supplies in the Southwest—by Robert Dott, Director, Oklahoma Geological Survey, Norman, Okla.

Mr. Dott reviewed the cycle of water in nature. This paper concerned chiefly underground water supplies. Ground water was defined as being either free or confined. The underground water table depends upon rainfall. The safe yield of such water depends upon replacement by rainfall. Mr. Dott illustrated his paper with a geological map of Arkansas, Louisiana, Oklahoma and Texas. This map brought out the fact that there was a great variety of underground water-bearing formations in the four states. Using this map as a guide, Mr. Dott explained why water was scarce in some parts of this region and plentiful in others.

Reclamation of Used Water—by O. V. Lindell, The Dorr Co., Kansas City, Mo.

This paper was omitted due to illness of Mr. Lindell. In its place the paper following was moved up from its scheduled position later on the program.

Drilling of Wells—by Mr. E. A. Vaubel, Lane-Texas Co., Houston, Texas.

Mr. Vaubel stated that wells cannot be drilled haphazardly and for best results a good working knowledge of underground condition is necessary. A list of wells which have been drilled in various cities in Texas were given. Each of these wells illustrated methods used in various types of underground structure. The first was a well at Brady, Texas, listed as a "hickory sand well." The depth of the well at which good quality water was found was 2,000 feet. In this case, it was necessary to use nitro glycerine to get the desired yield.

The next well was the so-called

Bob Gresham
Editor
S.W.W.W. Journal
Temple, Tex.
(A "seegar" and a smile—that's Bob)

Ed R. Stapley
Dean of Engr'g
Okla. A. & M.
Stillwater, Okla.
(Presiding officer, closing session)

San Antonio well, which was drilled through rock, and known by well drillers as a rock well. Good water was obtained at 1,800 feet.

The third well mentioned in this paper was the Bastrop well, which is known as an alluvial sand well. In this well good water was encountered at a depth of 50 feet, water in the deeper strata being unsatisfactory.

A typical sand-stone well was illustrated by a well at Rogers, Texas. This well had a water temperature of 140° F.

Fifth and last, a well drilled by the Lane-Texas Co. at Palestine, Texas, was designated as a loose sand well. Water from this well was ample and of fair quality.

This paper dealt chiefly with the various types of water bearing strata encountered by well drillers in Texas. To some extent the various drilling methods required in each case was given.

Pending Legislation Affecting Water Supplies—by A. F. Mitchell, President, Texas Society of Professional Engineers, Corsicana, Texas.

Mr. Mitchell spoke at length on two bills which are now pending in the United States Senate which will seriously affect water works men in the Southwest. These bills regulate the sale of water on Federal and State Flood Control Dams, in that the control of such dams is vested with the Secretary of War, and administered by the Chief of the Army Engineers.

Mr. Mitchell stated that under the provisions of these bills, the rice growing industry in Texas would be seriously curtailed. This was due to the fact that one provision of this bill restricted the amount of water from all flood control dams in Texas that could be sold to rice growers. He stated that this bureaucratic bill abrogated state rights and should be protested by water-works men in this area.

In the absence of Mr. Chas. S. Clark, Chairman, Texas State Board of Water Engineers, Austin, Texas, Mr. Mitchell's paper was discussed by Judge Stirrah.

Judge Stirrah criticized these two bills in that they curtailed state rights as to the use of state waters, although each bill contained much good otherwise. He emphasized the fact that any flood control dam constructed becomes the property of the Federal Government, regardless of the owner, and that all water sold from such impounded supplies is regulated by the Secretary of War and administered by the Chief of the Army Engineers.

The speaker quoted recent Supreme Court decisions which gives the Federal Government control over all tributaries as well as the main stream.

Judge Stirrah ended this discussion by asking for a resolution from the Southwest Section to ask passage of these bills, but without their objectionable features. The speaker had a prepared resolution to this

Lieut. A. M. Avery III
U.S.N.R.
and
"Dad" Avery
Nat'l C. I. Pipe
Dallas, Tex.

Arthur T. Clark
Secy.-Mgr.
W. & S. Mfrs. Assn.
and
"Reggie" Hayes
Sales Mgr.
Hyd. Devel. Corp.
New York

Hon. Tom Miller
Mayor of Austin
Delivering a welcome of more than mere words in the hall of famed Mirrors of Maximilian

Egmont Smith, Chm'n
and
F. ("Vic") Soule of the
S. W. Mfrs. Comm.
with
"Art" Clark, Mgr.
W. & S. Wks. Mfrs. Assn.

E. H. Ingle, Pres.
Electro Rust-Proofing, Inc., Dayton, Ohio
with
Ronald MacDonald
Electro Rust-Pr'f'g, Inc.
New Orleans

effect which was read before the Conference. This resolution brought about much discussion from the floor. Mr. Victor Ehlers, Chief Engr., Texas Health Dept., asked that the resolution be amended to give the individual State Boards of Health the power of sanitary control over such flood control installations. After much discussion this resolution was passed by the Conference with the recommendation that copies be sent to all governors and congressmen in the states which would be affected by this legislation. It was brought out that 29 states would be affected.

Boiler Feed Water Treatment—by M. C. Schwartz, Asst. Director, Engineering Experiment Station, Baton Rouge, La.

Mr. Schwartz pointed out the difference between the operation of low and high pressure boilers. He stressed the fact that the greater pressure kept on a boiler the greater refinement of the feed water treatment required.

This paper was illustrated with several graphs showing the effect of scale in preventing heat transfer through the boiler tubes to the water inside of the boiler. The fact was brought out that at the higher boiler temperatures and pressures absolutely no scale could be tolerated in the tubes.

When asked as to how to determine the efficacy of any feed water treatment, Mr. Schwartz replied that while many tests were available the most practical and sure way was to observe the results in a boiler for a few months. He stated that too little work had been done in the past on this problem. He stated that the Du Pont Co. had built an experimental boiler which used special prepared water. This work was for the purpose of determining the actual temperatures at which boiler tubes failed when using different types of feed waters.

On being asked how to control boiler plants already in operation, he stated that the best method was to use experimental boiler tubes. He closed his paper by saying that there was a great need for added refinement of boiler water treatment methods.

Prof. O. M. Smith, Oklahoma A. & M. College, Stillwater, Okla., was the scheduled discussor.

He showed some interesting graphs on which scale thickness was plotted against heat transfers. He emphasized that scale formation should be eliminated, adding the fact that the type of scale was very important. Analysis of the boiler scale is quite often rather important. The manner in which scale is formed in a boiler determines to a great extent the thermal conductivity.

Dr. Smith was asked if there were any good mathematical formulae for determining boiler water treatment. He replied there were several such formulae, but that none were very good, and that actual control was still the only way.

Water Works Materials Today and Tomorrow

Outlook on Water Works Materials—Walter L. Picton, Regional Engineer, Water Div., Office of War Utilities (W.P.B.), Washington, D.C.

Mr. Picton stated that there were two outstanding things that water-works men should take heed of. The first of these was the securing of materials for the maintenance of the physical plant. The second was that they should apply as early as possible for priorities for new construction. He stressed the fact that, if water works operators are too long using their present high priorities, when the European War is over many others would be able to use these same priorities which would make it difficult for the water-works men to get their necessary material.

He stated that the War Department had now made steel available for construction of elevated water tanks and urged that application for such material be filed at the earliest possible date.

Other things brought out in this paper were that carload lot shipments of pipe could now be obtained. Due to the fact that a coal shortage is expected this winter, he urged that plant operators keep up their coal stock from here on out.

Mr. A. Webb Roberts, Regional Representative, Government Division, W.P.B., Dallas, in discussing Mr. Picton's remarks, emphasized the need for haste in purchasing all essential water works material. In answer to questions as to the proper use of the AA-1 priority, Mr. Roberts stated that this priority rating applied to all water works operations except transmission and distribution.

SESSION ON WATER TREATMENT

Vice Chmn., A. H. Ullrich, Fort Smith, Ark., Presiding

Chlorination

"Bacterial Efficiency of Free Chlorine Residual," by A. E. Griffin, Dept. of Research and Development, Wallace and Tiernan Co., Newark, N. J.

F. T. Redman, Sales Engr., Calgon, Inc., Pittsburgh, Pa. — *H. H. Clayton, Manager, Water & Sewage, Lewisville, Ark.* — *F. B. Griffin ("Red"), W. & T. Co., San Antonio, Tex.* — *Frank Baldwin, Engr. in Chg. Water Div., Houston, Tex.* — *Francis Hersey, Vice-Pres., Hersey Meters, Boston, Mass.*

Unable to attend the meeting, Mr. Griffin's paper was read by J. M. Van Gelder of Wallace & Tiernan's Dallas Office. The paper contained essentially the same material as was presented by the author a short time previously before the New Hampshire Water Works Assn. A digest covering this paper was printed in our report on the New Hampshire meeting and is to be found on page 399 of our November issue. For this reason we will merely highlight Mr. Griffin's paper by saying that it discussed the efficiency and speed of bacterial kill by residual chlorine in various amounts and the effect of pH and temperature on the rates of bacterial kill. As the pH value goes up above pH 7 the rate of kill is reduced and as the temperature is reduced the rate is likewise reduced. The presence of ammonia farther slows up the rate.

In discussing "break-point" chlorination effects, the alkalinity and temperature are even more markedly influencing. At pH 10 for example the rate of oxidation and destruction of ammonia or taste compounds may be so slowed up as to require 42 hours for the result that is procured in 2 hours at pH 7.

As to temperature effects, 70° F. seems to be optimum while at freezing temperature 2 hours may be required in comparison with 5 minutes at temperatures in the neighborhood of 100° F.

Mr. Griffin emphasized the results with "break-point" chlorination as regards so-called bacterial aftergrowths in the distribution system, citing data to show that once really chlorine saturated, the water did not seem to support aftergrowths—or in any case the aftergrowth phenomena had been eliminated.

Mr. Griffin discussed the improved tests for residual chlorine, stating that the only residual that could be depended upon was that coming up in the so-called flash test —i.e., the color produced with orthotolidine immediately. Nothing superior to this test had been found for controlling "break-point" chlorination. In prechlorination he advocated a dosage sufficient to show a flash test of not less than 1 ppm. for chlorine at the filters. As an aid in combating tastes and odors he told of the efficacy of aeration just ahead of the filters.

Linn H. Enslow, Editor *Water Works and Sewerage,* and advisor for The Chlorine Institute, in reviewing several pertinent considerations and basic laws in water clorination practices, amplified the paper by Mr. Griffin. He pointed to the newest development as that of "Chlorite Treatment" in which a solution of Sodium Chlorite added to the stream from a chlorinator produces the powerful oxidant chlorine dioxide (ClO_2) which, like ozone actually destroys taste and odor creating compounds. Apparently 0.5 to 0.75 ppm of ClO_2 does the job, even where phenolic bodies are the trouble makers. The method holds great promise in the opinion of those who have watched its performance at several points already.

(In this same issue is a featured article which presents the details of this newest of chlorination processes —"Chlorine Dioxide Treatment.")

Disposal of Salt Water From Oil Fields

In the Southwest the disposal of salt water from oil wells is a problem of some magnitude; therefore the following two papers on this topic received a lot of interest. In fact both were well worth listening to.

"Salt Water Disposal by the Ground Injection Method," by W. S. Morris, Vice Pres. and Genl. Mgr., East Texas Salt Water Disposal Co., Kilgore, Tex.

Mr. Morris in a splendidly presented paper described the method of pumping the salt water, otherwise flowing to streams and ruining water supplies, back into the earth by high pressure pumping. By this method the salt water is forced back to the oil bearing strata from whence it came. Perhaps the most interesting part of the scheme is the degree of purification or treatment which the waste brine must receive before being returned to the deep sandstone strata which otherwise would soon become plugged with the gums, waxes, silicon, iron and other impurities contained. In the East Texas field there are 435,000 barrels (42 gals. each) of this waste brine to be returned to the earth daily.

Programmers

Leslie A. Jackson
Manager
Water Dep't
Little Rock, Ark.

Walter B. Picton
Regional Engr.
Water Div., WPB
Washington

Treatment of the water in 36 plants scattered over the field before pumping into the 32 injection wells constitutes the most important part of the procedure. Perhaps the most important impurity to be removed is the iron, which runs as high as 14 ppm. in some of the brines. The treatment consists of aeration and lagooning to separate the free oil. The lagoon effluent is then chlorinated, oxidizing the iron and serving to break the oil emulsion. The brine is then again aerated and flocculated with alum and lime enough to raise the pH to 7. After 24 hours settling the brine is filtered through pressure type sand filters at 3.2 gal./sq. ft./min. rate and then pumped into the injection wells. The filters are back-washed every 12 hours. The injection wells take varying quantities of brine, the highest rate being 18,000 bbls. per 24 hours through one of the wells.

Interesting feature of this method has been the economic gain in oil pumping costs. The brine discharged under pressure beneath the oil bearing sandstone has caused an appreciably higher yield from the oil well pumps, and also from the wells that flow naturally, than was observed before the return process went into operation in October 1942.

Answering questions Mr. Morris said that cement lined steel pipe was being used for the brine lines. The Disposal Co. is paid by individual producers on the basis of volume of brine handled for each.

"Impounding Reservoirs for Brine Disposal" was a paper scheduled to be presented by M. F. Granville, Field Supervisor, Salt Water Control, Tyler, Texas. Since the author was not present his paper was not read, but will be printed, it is understood.

"A Solution for the Oil Field Brine Disposal in Texas," by A. M. Brenneke, Engr. on Salt Water Control, State Dept. of Health, Denison, Texas.

Mr. Brenneke, formerly Supt. of Water at Denison, has more recently been studying the brine disposal problem for the State Dept. of Health and has developed a plan for solution of the problem. Before presenting the plan he reviewed the catastrophe of ruined public water supplies and small streams by oil field brines. One example was the forcing of Longview, Texas, to abandon its water supply source and spend $400,000 to bring in a new supply.

To control the situation Mr. Brenneke proposed the establishment of a Texas Salt Water Control Commission at an estimated cost of $75,000 per year and thereby remove the problem from several State agencies at present concerned and attempting to duplicate the work of each other. To raise the $75,000 he advocates a tax of 1 mill per barrel of oil produced. This, he said, was sufficient and just one fourth of the fee levied against Kansas producers by the State of Kansas.

Following his proposal a resolution was passed which advocated release of his paper to the newspapers of Texas and supplying every State legislator with a reprint of the paper and the proposal endorsed by the Section.

"Experiences Gained in Furnishing Water to the Army" was a paper which was to have been read by Col. H. W. Keller, Deputy 8th Service Command Engr., U. S. Engrs., Dallas, Tex., but due to the crowded

program was presented by the author for printing and not read. The audience expressed some disappointment when Col. Keller stepped down with his paper unread.

Hoskins on Drinking Water Standards

"U. S. Drinking Water Standards" was the topic assigned Admiral J. K. Hoskins, Asst. Surgeon Genl. and Chief Sanitary Engr., of the U. S. Public Health Service, Washington, D. C.

The Admiral discussed the new U.S.P.H.S. Standards for Drinking Water, explaining the reasons for those portions of the new standards which are being "shot at" by the water works fraternity. He made it plain that the standards had been developed with the assistance and guidance of an advisory committee composed of representatives appointed by the AWWA, ACS, APHA, Conf. of State San. Engrs. and other interested national groups. These standards might appear to be "idealistic" in certain portions, but it was not expected that anyone would suffer unduly. Furthermore, as always, the State Sanitary Engr. would be depended upon to give his evaluation of all water supplies requiring certification by the Public Health Service. Without question, as time went on the present standards would be subject to such revisions as experience indicated to be justified. This statement was reassuring to many.

[In our forthcoming report of the California Section's Annual Meeting the Hoskins' presentation is more adequately reported. We regret our inability to print the California report in this same issue, but we are still operating under the paper use limitation orders—and that's that.—Ed.]

Because of the absence of the authors the following papers were presented by title for subsequent publication.

"Lime Slaking, Stabilization of Water and Softening Sludge Utilization"—by Frank S. Taylor, Filtration Engr., Okla. City, Okla.

"Zeolitic Softening and Stabilization with Lime and Polyphosphates"—by L. C. Billings, Supt. of Water Purification and Sewage Treatment, Dallas, Tex.

Session on Licensing and Training

Prof. Edw. R. Stapley, Stillwater, Okla., Presiding*

The subject of "Licensing and Training of Water Works Personnel" was presented as a symposium by representatives from the four states of the Section.

Arkansas

According to Prof. W. R. Spencer of the Univ. of Arkansas, Fayetteville, Ark., a licensing plan on a voluntary basis, as recommended by a special committee appointed in 1939, was approved and adopted at the 1940 Annual Water and Sewage Conference. Three grades of licenses, grades A, B and C, were provided. Four divisions—Water Source and Pumping, Water Treatment, Distribution and Metering, and Supervision and Finance—were made in each grade. The plan included no "grandfather clause." Examinations were to be held in connection with the Annual Arkansas Conferences. Complete information concerning his experience and scholastic training must be furnished by the applicant to the secretary of the five-man licensing board.

Professor Spencer reported a total of 74 licenses granted so far out of about three times that number of applicants. For grade A licenses 34 men have qualified with 23 of these being in all four divisions; for grade B license 29 men, with 15 of these in all divisions; for grade C license 11 men, with 5 of these in all divisions.

Louisiana

A program of voluntary certification of water department personnel was adopted in 1940 by the Louisiana Conference on Water Supply and Sewerage according to John H. O'Neill, Director, Div. of Public Health Eng. of the Louisiana State Board of Health. The plan provided for three classes of certificates, A, B and C, to be issued by the Conference on the recommendation of an examining board following examination of applicants. A representative of the State Board of Health, a representative of the College of Engineering of Louisiana State University, a representative of the State Department of Education and two representatives from the Conference form the five man examining board. Examinations are held at the time of the annual short course at the University.

The class C examination is both oral and written. It is quite elementary but covers the basic principles of water supply sanitation. The written part is given as a "true or false" test. For a class B certificate the examination is more difficult and covers the theory and operation of water treatment processes, hydraulics and distribution system maintenance. The class A examination is comprehensive and difficult.

During the three years that examinations have been given 13 men have passed Class C test, 17 have passed Class B out of 24 attempts, and only 3 have passed Class A out of 15 attempts. Copies of questions with correct answers are now sent to each person taking an examination.

An experienced itinerant instructor employed by the State Department of Education now visits individual communities and plants to give instruction to local personnel. In several Louisiana cities regular classes are held with the local superintendent, manager or other department employee acting as teacher.

Oklahoma

H. J. Darcey, Chief Engineer and Director, Bureau of Sanitary Eng. of the Oklahoma State Health Dept., gave a brief description of the 17 annual short courses which had been held at the Oklahoma A. and M. College from their inception in 1922 to their discontinuance after 1941, due to war conditions. He also described the one-day District Field Conferences which were held each year in 24 cities distributed over the state beginning in 1935 and continuing to 1942.

A comprehensive training program planned to cover a period of several years was inaugurated in 1935. Certain subjects were to be covered at the annual short course in Stillwater, others at the District Conferences, and still others at night classes to be established in various cities.

During the time this training program was in operation interest in licensing led to the introduction of a bill in the state legislature requiring the examination and licensing of water superintendents and plant operators. The bill passed the House of Representatives but failed by one vote on final roll call in the Senate. Later, a voluntary licensing program was adopted and a number of licenses, effective for a two-year period, were issued fol-

*For this portion of the report we are indebted to Prof. Stapley who prepared it. —Ed.

lowing examinations. Little interest was shown, however, and the licensing plan became inactive.

It is now hoped to obtain some of the good effects of licensing by granting permission to cities having approved supplies to erect "Approved Water Supply" signs on main highways, as has already been done in some states. Qualified personnel in charge must, of course, be one of the requirements for such approval.

Texas

The voluntary licensing plan adopted by the Texas Short School in 1933 is believed by V. M. Ehlers, State Sanitary Engr. of the Texas State Dept. of Health, to be one of the first of its kind to be inaugurated in the nation. Three classes of license, A, B and C, for the two types of supplies (well and surface) were approved. This plan with some changes adopted in recent years has been carried out by a more or less permanent committee of the Short School under the chairmanship of Dr. W. T. Gooch of Baylor University.

Originally, only the licensing of water superintendents, plant operators, laboratory directors, general managers of water companies, superintendents of distribution systems, sanitarians and sanitary engineers, with experience in water supply work, was contemplated. In 1941, following many requests the plan was broadened to include employees engaged in *all* phases of water supply operation. At this time provision was also made for the designation of four divisions, Administrative, Production, Control and Distribution. In 1943 it was decided to have licenses for grades A and B indicate in which of these phases the applicant had been examined and qualified.

Present general requirements for licenses in the various grades are as follows:

Grade C—One year water works experience and 20 hours attendance at Texas Annual Water Works Short Schools, District Short Schools, and special types of schools and district association meetings are required. Two hours per meeting is the credit allowed for attendance at district association meetings with hours of actual attendance allowed for other types of schools. Two additional years of experience may be substituted where attendance hours are lacking. This license is good for three years and may be renewed by making application and passing a new examination.

Grade B—Three years of experience in water works operation and 80 hours credit for attending short schools and district association meetings are required. A college degree in civil, chemical, or sanitary engineering, or bacteriology or chemistry may be substituted for 40 of the 80 hours. This license is good for five years and may be renewed by making application and passing a new examination.

Grade A—Eight years of experience in water works operation and 120 attendance hours are required. *Grade A licenses do not require renewal.*

A program for sewerage system operators' certification very similar to the water works operators' plan in procedure, rules and manner of issuance of licenses was adopted by the Texas Short School in 1938. E. J. M. Berg, Supt. of Sewage Treatment, San Antonio, has served as chairman of the committee for this latter program since its inception.

It is felt that the Texas voluntary plan has been highly successful. Over 2000 licenses have been issued to water works men and approximately 600 to sewerage system operators. These licensed men represent the water and sewer departments of 379 Texas cities with a total 1940 population of over 2,700,000.

A move by water works men themselves to give the voluntary licensing plan a legal basis by appropriate legislation has been discussed at times in the past. It is understood that a committee is now preparing a proposed bill for submission to the next session of the Texas legislature.

"In-Service Training of Personnel" was introduced briefly by Colonel Gwynne Conrad, Director of Personnel, Eighth Service Command, Dallas, Texas, who in turn introduced Captain McCarthy, Signal Corps, Washington, D. C. Captain McCarthy gave an interesting description of the J. I. T., J. M. T., and J. R. T. training courses which had been used very effectively to train thousands of supervisors in army programs.

"Present and Future Personnel Problems" were discussed by Colonel Guiton Morgan, substituting for Colonel Dwight Horton, Selective Service, Washington, D. C. Being on leave from the City of Austin as its city manager, Colonel Morgan's appearance was particularly appropriate. He gave a vivid picture of the returning veterans who have won the fight in uniform and are not to be licked when returning to civilian clothes. Although governmental units, such as municipalities, etc., are not required to reemploy returning veterans, they have a moral responsibility to do so. Proper planning is needed to provide employment for all, and certainly for all returning veterans. Col. Morgan indicated that this group of victors were to be given great consideration, since they would represent a force of powerful dimensions in the future of their Country and its political as well as economic and social behavior.

Prof. Velz to Direct Stream Studies for Pulp and Paper Industry

The National Council for Stream Improvement of the Pulp, Paper and Paperboard Industries announced the establishment of a research project at Manhattan College under the direction of Professor C. J. Velz, head of the Department of Civil Engineering. The project will consist of a sanitary analysis of the watersheds in which the industry is concerned. It will include calculations of projected stream profiles for the purpose of determining the degree of responsibility of the pulp, paper and paperboard industries in relation to other industries for pollution and point out what degree of abatement is necessary to return streams to a condition, satisfactory for uses to which they are put. This information will also help in guiding the research program conducted by the Council which is concerned with treatment and recovery of wastes and insure the industry against investment in inadequate treatment facilities.

Professor Velz is recognized as an authority on the subject of stream calculation, having been instrumental in the development of the basic equations now in use.

CHLORINE DIOXIDE – A DEVELOPMENT IN TREATMENT OF POTABLE WATER*

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THE chemical purification of public water supplies in this country is hardly forty years old. In this time, the use of chlorine gas or of hypochlorites in water treatment has become standard practice throughout the United States.

Now an even more effective water treatment has become possible, utilizing the powerful oxidizing gas, chlorine dioxide, ClO_2.

Chlorine dioxide, because of its instability, cannot be produced in bulk and stored until wanted. It must be generated in very low concentrations at the point of use, and consumed immediately. This was not feasible until recently, chiefly because of the difficulties inherent in the accepted method of generating the gas by reacting potassium chlorate with sulfuric acid. This method is low in production efficiency, does not give a pure product, gives rise to serious corrosion troubles, and is difficult to control.

A new source of chlorine dioxide was made available a few years ago when sodium chlorite, $NaClO_2$, was introduced commercially. Pure sodium chlorite is a white powder, stable both in the solid state and in solution. It is intermediate in properties between hypochlorite and chlorate, and contains 158 per cent available chlorine†. The commercial product is flaked and contains approximately 75 per cent chlorite.

Methods of Preparing ClO_2

Several methods have been developed to prepare chlorine dioxide from sodium chlorite. The earliest of these was an electrolytic method[1] based on the reaction:

$$2\,NaCl + 2\,NaClO_2 + 2\,H_2O \xrightarrow{2\ Faradays} 2\,ClO_2 + 2\,NaCl + 2\,NaOH + H_2$$

This process produces chlorine dioxide under satisfactory conditions for certain uses[2], but requires complicated equipment. It was therefore abandoned when simpler and purely chemical processes were introduced.

The first of these chemical proc-

The Senior Author

esses[3] was based on the fact that when chlorine is introduced into a solution of sodium chlorite, the following over-all reaction takes place at room temperature:

$$2\,NaClO_2 + Cl_2 \longrightarrow 2\,NaCl + 2\,ClO_2$$

This process, utilizing suitable control, measuring, and safety devices, is practicable.

Recently a method of generating chlorine dioxide by treating dry sodium chlorite with chlorine has been developed[4]. A mixture of chlorine and air is passed through two towers, lined with stoneware, and filled with flaked sodium chlorite. Chlorine dioxide is formed in accordance with the above reaction. Control of the air and chlorine supplies regulates the amount of chlorine dioxide formed[5].

For many processes, the dry method is superior to the wet process. In the treatment of water supplies, however, the wet method is more applicable. The most practical method for generating chlorine dioxide for water treatment consists in feeding a sodium chlorite solution into the discharge line of a Wallace and Tiernan chlorinator and passing the solution through a mixing chamber to complete the reaction.

Properties of Chlorine Dioxide

At ordinary temperatures and pressures, chlorine dioxide is a yellow to red, unpleasant smelling, irritating gas, with a vapor density of approximately 2.4. The odor of chlorine dioxide is evident at 14 to 17 ppm. and at 45 ppm. it is irritating.

At room temperatures,, it is soluble in water to the extent of 2.9 grams of chlorine dioxide per liter at 30 mm. partial pressure. Its aqueous solutions are decomposed by light.

The oxidizing power of chlorine dioxide, stated in terms of "available chlorine," is two and a half times that of chlorine itself. This is illustrated on a molecular basis as follows:

$$ClO_2 + 2\tfrac{1}{2}\,H_2 \longrightarrow HCl + 2\,H_2O$$
$$Cl_2 + H_2 \longrightarrow 2\,HCl$$

Chlorine Dioxide for Water Treatment

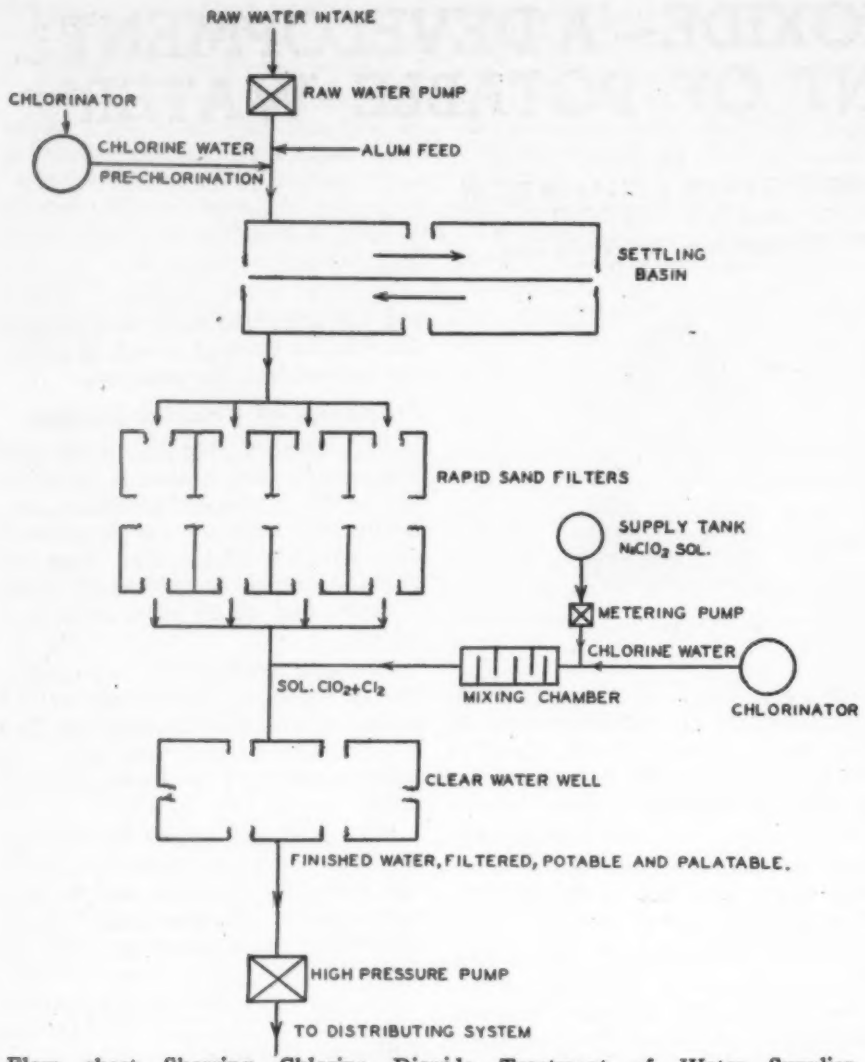
The development of a practical method for generating chlorine dioxide led to investigations of its use in water treatment for the destruction of tastes and odors (caused by phenolic wastes or algae), and for disinfection.

Bactericidal Action.—Chlorine dioxide, in our experience, is a more effective bactericide than chlorine when tested on distilled water to which E. Coli has been added. When used on polluted water, however, chlorine dioxide, because it is much more reactive than chlorine, destroys phenols, algae and other pollutants at the same time or prior to its at-

*Presented before the 63rd Annual Meeting of NEWWA at Poland Springs, Me., Sept. 19-22, 1944. Released for publication in *Water Works and Sewerage*, by the Editor of the Jour. NEWWA.

†Ed. Note. The term available chlorine is a misnomer. It is based on a fallacious concept that the concentration of chlorine in a hypochlorite solution is measured by the amount of iodine it will displace from a solution of potassium iodide, i. e., on the basis that one atom of chlorine will displace one atom of iodine. Actually one molecule of calcium hypochlorite, which contains but two atoms of chlorine will liberate four atoms of iodine from potassium iodide. The term "available chlorine" is therefore a measure of the total oxidizing power of the substance being tested and is twice the active chlorine value by weight. "Available chlorine" is determined by titrating the iodine released by the hypochlorite from an acidic solution of potassium iodide and is calculated as per cent by weight of the original hypochlorite. Some calculated theoretical "available chlorine" contents of various hypochlorites are shown in the following table:

Substance	"Available Chlorine" Content
Cl_2	100.0%
HOCl	135.6%
NaOCl	95.4%
$CaOCl_2$	56.0%
Bleach (impure $CaOCl_2$)	35.0%
$Ca(OCl)_2$	99.2%
HTH (impure $Ca(OCl)_2$)	70.0%
$NaClO_2$ (sodium chlorite)	158.0%
ClO_2 (chlorine dioxide)	250.0%



Flow sheet Showing Chlorine Dioxide Treatment of Water Supplies for Removal of Tastes and Odors

tack on bacteria. For this reason, the disinfection of polluted waters requires more chlorine dioxide than chlorine. This conclusion, stated by McCarthy[7], was borne out in a series of experiments using the following waters:

a. Merrimac River—Tap water from Lawrence, Mass.—culture of E. Coli added.
b. Merrimac River — Untreated — filtered only.
c. Niagara River—Tap water from Niagara Falls—culture of E. Coli added.
d. Niagara River — Untreated — filtered only.
e. Ohio River—Untreated—filtered only—from Cincinnati.

The results of these experiments to determine the comparative amounts of chlorine and chlorine dioxide required to disinfect these various waters are outlined in the following table:*

Water	Coliform Index of Sample	ClO_2 ppm.** for Complete Disinfection	Cl_2 ppm.** for Complete Disinfection
(a)	1,000,000	2.0	0.50
(b)	100,000	2.4	0.8-1.0
(c)	1,000,000	0.6	0.6
(d)	100,000	1.4	0.8
(e)	100,000	1.2	1.0

A comparison of the demand of these waters, i.e. to produce a test for residual chlorine, is shown as follows:

Water	ClO_2 Demand	Cl_2 Demand
(b)	1.99	0.66
(d)	1.01	0.66
(e)	0.89	0.65

The basic chlorine demand of these various waters remains fairly constant, but the chlorine dioxide demand varies with the degree of pollution, inasmuch as the chlorine dioxide reacts more readily with polluting substances than does chlorine. Therefore it will require more chlorine dioxide than chlorine to attain the disinfecting reaction.

Taste and Odor Control—For the improvement of taste and odor, chlorine, as ordinarily applied, has not been found to be entirely satisfactory, especially where phenolic pollution or considerable algae growths occur. The breakpoint method of chlorination, developed for this purpose within the past six years, is not always adequate. Where sharp breakpoints fail to occur, or where sudden fluctuations in pollution tax the chlorinator beyond its capacity, temporary shut-downs, or even new sources of water supply, become necessary.

Such a situation existed in an auxiliary filter plant of the City of Niagara Falls (N. Y.) Water Department. This plant, which supplies 3 to 8 mil. gal. per day, or approximately 10 to 20 per cent of the total water supply, has an "on-shore" intake which becomes so polluted, at some times with phenolic compounds, and at other times so infected with algae, that the ordinary method of treatment often failed to produce a palatable water. This condition is intensified by the fact that phenolic pollution comes in surges rather than at a constant rate, so that the water varies greatly even from hour to hour.

Treatment Used at Niagara Falls

Experiments undertaken at Niagara Falls to study the possibilities of chlorine dioxide as a solution to this problem have demonstrated that chlorine dioxide destroys such tastes and odors[6].

Because information on the bactericidal action of chlorine dioxide is still incomplete, it was considered inadvisable to attempt to utilize chlorine dioxide as a replacement for the chlorine now used for disinfection of the water. The treatment as developed at Niagara Falls therefore combines pre-treatment with chlorine for disinfection and post-treatment with chlorine dioxide to destroy taste and odor.

In the pretreatment, sufficient chlorine is fed to maintain a residual available chlorine of 0.4 to 0.5 ppm. in the settling basin, and 0.2 ppm. under the filters. This residual was regulated at first by the addition of carbon. Subsequently it was found that the use of carbon was unnecessary, and the residual is now being maintained simply by regulating the chlorine feed. A dosage of 1.5 ppm. chlorine is ordinarily sufficient for the purpose, but is increased when the chlorine demand of the water increases.

Along with addition of chlorine, alum is added for clarification. Usually, 17 ppm. of alum is sufficient, and the water is held in the settling basin for three hours, after which it is filtered. Following this treatment, chlorine dioxide is introduced

*Procedures as outlined in "Standard Methods of Water Analysis" were used throughout this work.

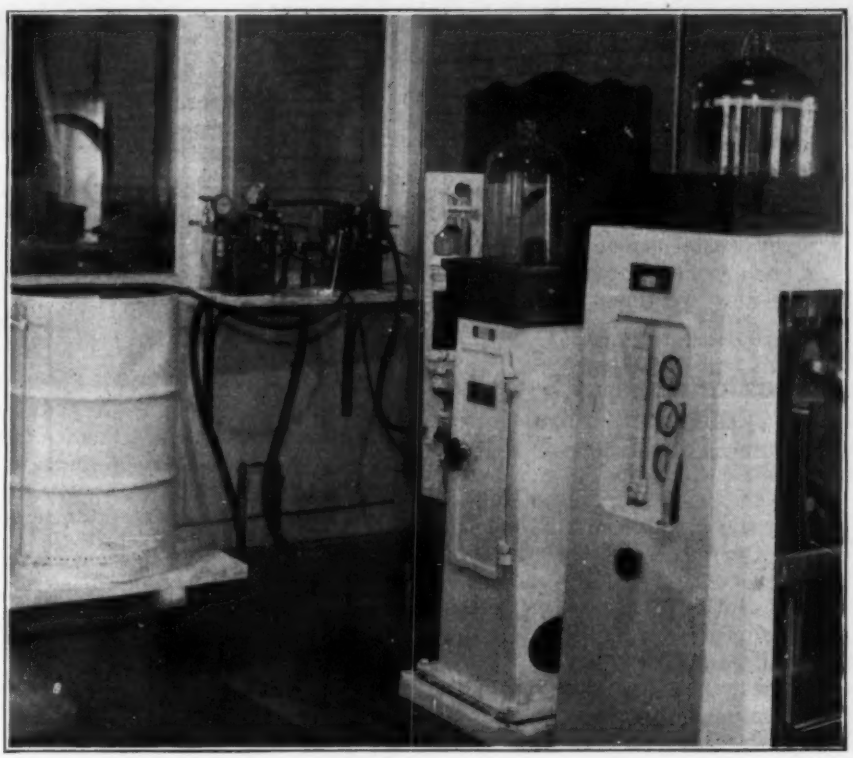
**Listed as ppm. available chlorine.

at the clear well in the manner described in the following paragraphs.

The sodium chlorite solution, containing 31 grams per liter of available chlorine, is fed by means of a metering pump into the discharge line of a Wallace and Tiernan chlorinator (shown in accompanying photographs), at the rate of 1.65 gallons of solution, or 0.42 pound available chlorine, per hour. The chlorinator is set to deliver two lb. of chlorine per mil. gal., equivalent to 0.25 lb. of chlorine per hr., at a pumping rate of three mgd. (The accompanying flow diagram shows the pretreatment, coagulation, filtration, and chlorine dioxide treatment.)

To assure complete conversion of chlorite to chlorine dioxide, an excess of chlorine is used. The reaction mixture is passed through a mixing chamber before entering the well. The cholrine dioxide dosage is maintained at a value of 0.5 to 0.75 ppm. available chlorine.

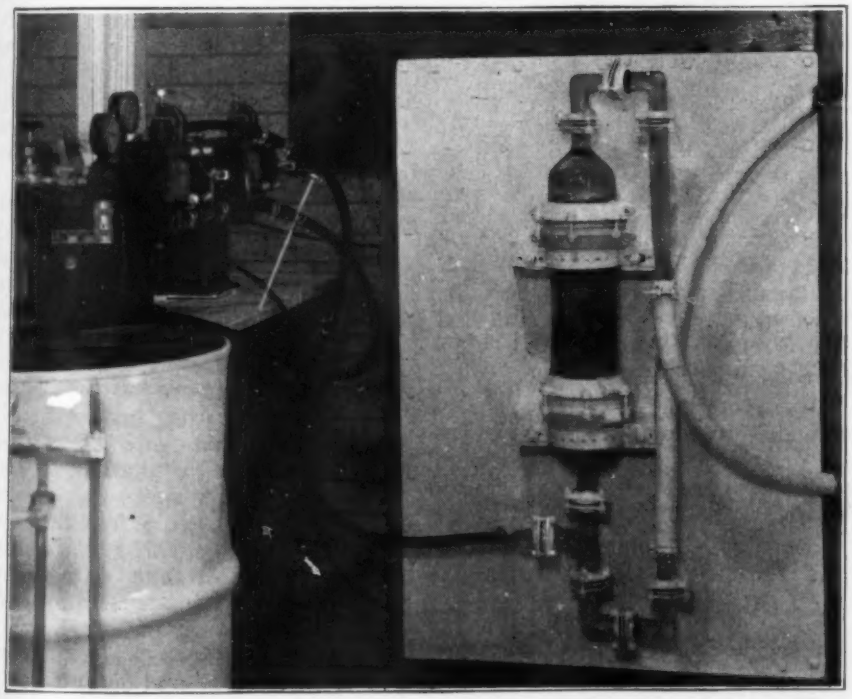
During the test runs, the concentration of phenol in the river was very high. Breakpoint tests in the laboratory indicated that, with the old method, doses of 15 ppm. of chlorine would have been required in some cases; and, on at least one occasion during the test period, the plant would not have been able to feed enough chlorine to handle the load, and would have been forced to shut down.



Apparatus for Chlorine Dioxide Treatment of Water at Niagara Falls, N. Y.
(At the left is the chlorite solution tank; center are the chlorite pumps, mixer and chlorinator for generation of chlorine dioxide applied as a post-treatment; at the extreme right is the chlorinator used for pre-chlorination.)

The taste and odor producing substances at the time of the initial tests were chiefly phenolic, inasmuch as this is the characteristic difficulty of the Niagara Falls water supply during the winter months. In the warm weather, however, the taste and odor difficulties are mainly the result of algae growths. Chlorine dioxide treatment eliminates both difficulties, efficiently and completely.

The entire water supply system of the city of Niagara Falls is now protected by chlorine dioxide treatment, to give year-'round operations without taste and odor difficulties.



Close-up View of Auxiliary Equipment Required to Generate Chlorine Dioxide
(Chlorite solution pumped from solution tanks at the left and chlorine solution fed from chlorinator to the right, react in the glass mixer to form a solution containing chlorine dioxide.)

Chemical Saving

It has been found, also, that a considerable saving in chemical costs is obtained by the use of the new method. On the basis of operation during one week the comparative costs were:

Old Method:

1080 lbs. chlorine	
1800 lbs. carbon	
Total cost	$157.50
Cost per million gallons	8.73

New Method:

163 lbs. chlorine	
46.2 lbs. chlorite	
Total cost	$ 43.10
Cost per million gallons	2.39

The saving per million gallons over the old method of treatment, therefore, was $6.34, or 72.5 per cent.

In addition to the saving in the cost of materials, plant operations have been simplified by the elimination of careful breakpoint measurements.

Summary

1. A new method of taste and odor control in water treatment has been described.
2. The method involves pretreatment of water with chlorine to disinfect it, followed by treatment with chlorine dioxide to destroy tastes and odors due to algae or phenolic wastes.
3. The new treatment permits continuous operation, reduces the amount of chlorine required, eliminates the use of carbon, and simplifies operation by making breakpoint measurements unnecessary.
4. Chlorine dioxide has also demonstrated bactericidal action, the dose required for disinfection varying with the amount of pollution.

References

1. Logan, U. S. Patent 2,163,793 (1929).
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Canadian Inst. of Sewage and Sanitation

11th Annual Convention a Record Breaker

Space does not permit a full report on the eleventh annual meeting of the CISS held at Toronto, Ont., but the record breaking success of the convention deserves more than passing mention.

Meeting in Toronto for the seventh time since the formation of the Institute, and inviting the ladies for the first time, produced a record turnout of 336 registrants. Of these approximately one-fifth were ladies and, of the other four-fifths attending, members and guests were about evenly divided. A registration of 136 members out of a membership of 199 speaks well for the organization and its energetic secretary, and the large number of guests attending indicates a fertile field for further growth.

The previous meeting drew 202 registrants when the membership was 157. This excellent growth in membership has been due largely to the efforts of W. H. Riehl, City Engineer of Stratford, as Chairman of the Membership Promotion Committee. After several successful years in this chairmanship, Mr. Riehl asked to be retired and his place was filled by B. F. Lamson, City Engineer of St. Catherines.

At the business meeting, the following officers were elected for the ensuing year:

President—R. J. Dasmarais (rhymes with O'Hara), City Engr., Windsor, Ont.

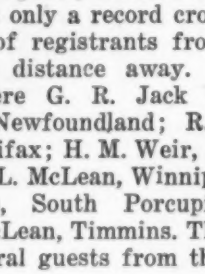
Vice-President—H. S. Nicklin, City Engr., Guelph, Ont.

Trustees—C. A. Mott, City Engr., Belleville, Ont.; N. MacNicol, Comm. of Works, Forest Hill, Ont.; Stanley Shupe, City Engr., Kitchener, Ont. (as Dir. of the Federation); J. B. Kinney, Wallace and Tiernan, Toronto (as repesentative of the Can. Sanit. Equip. Assoc.).

The next year's meeting will be held in conjunction with the Federation Meeting which probably will be held in Toronto early in October. This year's meeting which featured papers on Industrial Waste Disposal, Refuse Incineration, Town Planning, Snow Removal, and guided discussions on Sewer Maintenance, and Annual Reports, Records and Tests, drew not only a record crowd but a number of registrants from a considerable distance away. Some of these were G. R. Jack from St. John's, Newfoundland; R. D. McKay, Halifax; H. M. Weir, of Saskatoon; D. L. McLean, Winnipeg; C. S. Anderson, South Porcupine; and J. D. MacLean, Timmins. There were also several guests from the United States.

Norcom Heads N. J. Section

At the Atlantic City Meeting of the New Jersey Section of AWWA (registration 210) early in November, George Norcom, Consulting Engineer and Chemist of Red Bank, N. J., was elected president. Wm. E. Collings, Supt., Borough of Collingswood was elected vice pres. and Roswell P. Roper, Chief Engineer, E. Orange, was elected trustee.



George Norcom

The program included papers on cathodic protection, well drilling, water distribution from the customers' viewpoint, power interruptions, and rehabilitation of transmission mains.

Aurora Gas Engines Continue to Earn Money

Thirteenth Annual Report Summarizes Earnings

The Aurora, Ill., 1943 annual report recently issued by Walter Sperry, Supt., has in its summary some interesting comments, which are most interesting when left in Mr. Sperry's own language. For example, the author says of the report, "It is an audit of all plant operating procedures and a report of stewardship. It adds one more to a growing annual file of operating experience, plant changes and typical results . . . valuable to us for reference uses and to others for comparative purposes.

"Dec. 31, 1943, completed three years and one month of complete dependence on plant produced power and independence from the local power utility. There were no substantial power interruptions and only a few minor breakdowns."

Data tabulated show that the pumping engines costing $8,521 had earned $32,531 in 93 months, and the generator engines costing $9,800 had earned $5,656 in 37 months. These earnings are savings calculated from what purchased power would have cost.

All data are presented as pounds of material handled by the treatment plant, i.e., solids, B.O.D., grease, screenings, etc. These values in this unit are easily understood by the public and show what the treatment plant has accomplished, and how much of a load is discharged into the river.

In closing the summary, Mr. Sperry says, "Agreeable with good policy and by government request, a well considered post-war program is under study. It is not expected that this program will be completed in any one year, but that it will proceed as funds are available and somewhat in the order listed." Among the listed projects are interceptor sewers; installation of four aeration-flotation units in clarifier No. 1 for pre-clarifier treatment of raw sewage, primarily to remove hydrogen sulfide and gain better odor control; an intermediate receiving tank for transfer of sludge to improve sampling and allow concentration of sludge and decantation of supernatant liquor; and repairs to building roofs and clarifier house walls as well as enlarging the office and laboratory.

IONIC EQUILIBRIUM IN WATER

By H. M. GIFFT
Assoc. Prof. San. Engr.
CORNELL UNIV.
ITHACA, N. Y.

VARIOUS investigators have called attention to the fact that the method for calculating the three forms of alkalinity according to "Standard Methods" is incorrect. De Martini[1] presented equations for calculating free carbon dioxide and hydroxide, carbonate and bicarbonate alkalinities in terms of total alkalinity and pH. Moore[2] converted these equations to ppm. of free CO_2 and of equivalent $CaCO_3$ and presented them as four graphs. Dye[3] constructed four nomographic charts, and the 1942 Public Health Service Standards included a triangular coordinate diagram, both based on Moore's equations. As pointed out by Moore[2], the graphs were applicable at 25° C., pH values below 10.0, and total solids content less than 500 ppm. Above these values direct solution of the equations* was suggested.

Inasmuch as most waters have pH values of less than 8, the (OH^-) and $(CO_3^=)$ contents are insignificant and, to all practical purposes, the (HCO_3^-) content is equal to the total alkalinity. It is only for waters of high pH, and often of high alkalinities and total solids content, that determinations of (OH^-) and $(CO_3^=)$ are of importance. Therefore, these methods which are applicable only within certain ranges are of limited use.

New Equations

It is possible, however, to evolve three equations which are more easily solved than are those of Moore[2]. Further, by a proper construction of scales, these equations can be combined into one simple chart which yields results directly and without interpolation for any alkalinity content or pH.

The Author

From familiar equilibrium equations we have

$$\frac{[H^+] \times [CO_3^=]}{[HCO_3^-]} = K_2' \quad \text{.....Eq. (1)}$$

and $[OH^-] \times [H^+] = K'_w$ .....Eq. (2)

or $\log (OH^-) = pH - pK'_w + 4.70$..Eq. (2a)

from which we obtain

$$\frac{[OH^-] \times [HCO_3^-]}{[CO_3^=]} = \frac{K'_w}{K'_2} \quad \text{.....Eq. (3)}$$

or

$$\frac{(OH^-) \times (HCO_3^-)}{(CO_3^=)} = 2.5 \times 10^1 \frac{K'_w}{K'_2} \quad \text{.....Eq. (3a)}$$

where (OH^-), (HCO_3^-), and $(CO_3^=)$ represent concentrations in terms of ppm. as $CaCO_3$.

Also

$(OH^-) + (CO_3^=) + (HCO_3^-) =$ Total alkalinity .....Eq. (4)

The three forms of alkalinities may be determined by first solving Eq. (2a) for (OH^-) and then solving Eq. (3a) and (4) simultaneously for $(CO_3^=)$ and (HCO_3^-). Tables I, II, and III include the most recent data on equilibrium constants as reviewed by Larson and Buswell[4].

Simple Nomograph

The exact numerical solution of these equations is rather cumbersome and beyond the accuracy ordinarily required. For these reasons the construction of a simple chart applicable to waters ordinarily encountered has been undertaken. In designing the chart the following simplifying assumptions seemed justified.

As most laboratories are equipped to make pH measurements at 25° C. or room temperature only, the temperature effect might logically be eliminated. On the other hand, as the value of K'_w and K'_2 are influenced by the solids content of the water, a correction for this variation was considered necessary.

According to Larson and Buswell K'_w/K'_2 varies 26 per cent between 0 and 1000 ppm. which is equivalent to a pH variation of ± 0.06 or a temperature variation of ± 2.5° C. (The constants used by Moore vary only ± 0.02 and ± 0.6° C, respectively). K'_w varies 27 per cent over the same range which is also equivalent to a pH variation of ± 0.06 or ± 1.8° C.

TABLE I

pK'_w and $K'_w \times 10^{14}$ for Different Temperatures and Total Solids Content (from Larson and Buswell)[4]

Total solids—ppm.	pK'_w / $K'_w \times 10^{14}$	Temperature—°C 0	10	20	25	30	40	50	60	70*	80*
0		14.94	14.53	14.17	14.00	13.84	13.53	13.26	13.02	12.81	12.63
		0.12	0.30	0.68	1.008	1.46	2.92	5.47	9.64	15.50	23.50
200		14.88	14.47	14.11	13.94	13.78	13.47	13.20	12.96	12.75	12.57
		0.13	0.34	0.78	1.15	1.66	3.39	6.32	10.96	17.80	26.90
400		14.85	14.44	14.08	13.91	13.75	13.41	13.17	12.93	12.72	12.54
		0.14	0.36	0.83	1.23	1.78	3.63	6.76	11.75	19.1	28.8
600		14.83	14.42	14.06	13.89	13.73	13.42	13.15	12.91	12.70	12.52
		0.15	0.38	0.87	1.29	1.86	3.80	7.09	12.30	20.0	30.2
800		14.82	14.41	14.05	13.88	13.72	13.41	13.14	12.90	12.69	12.51
		0.15	0.39	0.89	1.32	1.91	3.89	7.25	12.60	20.4	30.9

*Values for 70° and 80° extrapolated.

$$*(CO_3^=) \text{ as ppm. } CaCO_3 = \frac{5.61 \times 10^{-6}}{[H^+]} \times \left(\frac{\frac{Alk}{50000} + [H^+] - \frac{10^{-14}}{[H^+]}}{1 + \frac{11.22 \times 10^{-11}}{[H^+]}} \right)$$

$$(HCO_3^-) \text{ as ppm } CaCO_3 = 50000 \left(\frac{\frac{Alk}{50000} + [H^+] - \frac{10^{-14}}{[H^+]}}{1 + \frac{11.22 \times 10^{-11}}{[H^+]}} \right)$$

$$(OH^-) \text{ as ppm } CaCO_3 = \frac{5 \times 10^{-10}}{[H^+]}$$

$$CO_2 \text{ as ppm} = 9.70 \times 10^{10} \times [H^+] \left(\frac{\frac{Alk}{50000} + [H^+] - \frac{10^{-14}}{[H^+]}}{1 + \frac{11.22 \times 10^{-11}}{[H^+]}} \right)$$

TABLE II

pK'$_2$ and K'$_2$ × 10^{11} for Different Temperatures and Total Solids Content (from Larson and Buswell)[4]

Total solids—ppm.	pK'$_2$ / K$_2$×10^{11}	Temperature—°C 0	10	20	25	30	40	50	60*	70*	80*
0	pK'$_2$	10.63	10.49	10.38	10.33	10.29	10.22	10.17	10.14	10.13	10.12
	K$_2$×10^{11}	2.36	3.24	4.20	4.69	5.13	6.03	6.73	7.20	7.51	7.55
200	pK'$_2$	10.50	10.36	10.25	10.20	10.16	10.09	10.04	10.01	10.00	9.99
	K$_2$×10^{11}	3.16	4.36	5.62	6.30	6.91	8.12	9.11	9.75	10.00	10.23
400	pK'$_2$	10.46	10.32	10.21	10.16	10.12	10.05	10.00	9.97	9.96	9.95
	K$_2$×10^{11}	3.46	4.78	6.16	6.90	7.59	8.90	10.00	10.70	10.95	11.22
600	pK'$_2$	10.43	10.29	10.18	10.13	10.09	10.02	9.97	9.94	9.93	9.92
	K$_2$×10^{11}	3.72	5.12	6.60	7.40	8.12	9.55	10.70	11.47	11.75	12.02
800	pK'$_2$	10.40	10.26	10.15	10.10	10.06	9.99	9.94	9.91	9.90	9.89
	K$_2$×10^{11}	3.98	5.50	7.08	7.90	8.70	10.23	11.47	12.30	12.58	12.88

*Values for 60°, 70° and 80° extrapolated by Larson and Buswell.

TABLE III

pK'$_s$ and K'$_s$ × 10^7 for Different Temperatures and Total Solids Content (from Larson and Buswell)[4]

Total solids—ppm.	pK'$_s$ / K'$_s$×10^7	Temperature—°C 0	10	20	25	30	40*	50*	60*	70*	80*
0	pK'$_s$	8.02	8.15	8.28	8.34	8.39	8.51	8.62	8.74	8.86	8.97
	K'$_s$×10^7	9.50	7.07	5.25	4.57	4.03	3.06	2.37	1.83	1.38	1.06
200	pK'$_s$	7.80	7.93	8.06	8.12	8.17	8.29	8.40	8.52	8.64	8.75
	K'$_s$×10^7	15.85	11.75	8.70	7.56	6.75	5.13	3.98	3.02	2.29	1.78
400	pK'$_s$	7.73	7.86	7.99	8.05	8.10	8.22	8.33	8.45	8.57	8.68
	K'$_s$×10^7	18.62	13.8	10.25	8.90	7.95	6.02	4.68	3.54	2.69	2.09
600	pK'$_s$	7.69	7.82	7.95	8.01	8.06	8.18	8.29	8.41	8.53	8.64
	K'$_s$×10^7	20.4	15.15	11.2	9.75	8.70	6.60	5.12	3.89	2.95	2.29
800	pK'$_s$	7.66	7.79	7.92	7.98	8.03	8.15	8.26	8.38	8.50	8.61
	K'$_s$×10^7	21.9	16.2	12.0	10.45	9.32	7.08	5.50	4.17	3.16	2.46

*Values for 40° and above extrapolated by Larson and Buswell.

Because of these small variations and because of the inaccuracies inherent in the pH and alkalinity measurements and in the determination of the equilibrium constants themselves, the empirical assumption that the total solids content is twice the total alkalinity was considered satisfactory for the construction of the alinement chart in Fig. 1.

According to MacInnes and Belcher[5] K'_1 varies only approximately 1 per cent up to 1000 ppm. total solids. Therefore, using $K'_1 = 4.54 \times 10^{-7}$ at 25° C and converting to ppm, equation (7) becomes

$$\text{ppm } CO_2 = 1.94 \times 10^6 \times [H^+] \times (H\,CO_3^-) \quad \text{.....Eq. (8)}$$

The free CO_2 scale in Fig. 1 was constructed from this equation.

Knowing the total alkalinity and pH of a solution (at 25° C) it is a relatively simple matter to determine the three forms of alkalinity and free CO_2 by means of the alinement chart. The value of (OH^-) is obtained directly from the observed pH. The values for $(CO_3^=)$ and (HCO_3^-) are obtained by pivoting a straight edge until $(CO_3^=) + (HCO_3^-) =$ Total Alkalinity $- (OH^-)$. Both the necessary mental arithmetic and the location of the proper line are easily accomplished.

Examples

Two examples of the use of the chart follow:

I. Analysis: Alkalinity 100 ppm. as $CaCO_3$. pH = 10.0.

Solution: PH of 10.0 corresponds to 5.5 ppm on the (OH^-) scale. Pivoting a straight edge about this point until $(H\,CO_3^-) + (CO_3^=)$ equals $100 - 5.5 = 94.5$, we find $(CO_3^=) = 52$ ppm. and $(HCO_3^-) = 42.5$ ppm. Of course, the CO_2 content is insignificant in this pH range.

II. Analysis: Alkalinity 180 ppm as $CaCO_3$. pH = 6.9.

Solution: It is easily seen that both (OH^-) and $(CO_3^=)$ values are not significant, thus making the (HCO_3^-) content practically equal to the total alkalinity. A straight edge lined beween $(H\,CO_3^-) = 180$ and pH = 6.9 indicates free $CO_2 = 42$ ppm.

Calcium Carbonate Saturation

Langelier[6] made use of these fundamental equations, along with the solubility product for $CaCO_3$, to derive an equation expressing the theoretical pH of a water at $CaCO_3$ saturation in terms of the total alkalinity and actual calcium content. He emphasized the fact that the "Standard Methods" procedure for determining the amount of (OH^-) and $(H\,CO_3^=)$ was in error under certain conditions. In all probability it was for this reason that the final equation was expressed in such a complicated form.* Larson and Buswell[4] proposed a variation of this equation which included correction factors for solids and temperature. The equation was limited to waters of pH below 10.0.

With satisfactory methods for the determination of the (HCO_3^-) alkalinity, it is possible to derive a simple expression for the pH at $CaCO_3$ saturation which is applicable throughout the pH range. By using the corrected values for the equilibrium constants for different temperatures and solids content, the method is further simplified. Combining the equilibrium equations

$$[Ca^{++}] \times [CO_3^=] = K'_s \quad \text{.....Eq. (9)}$$

and

$$\frac{[H^+] \times [CO_3^=]}{[HCO_3^-]} = K'_2 \quad \text{.....Eq. (2)}$$

we obtain

$$[H^+] = \frac{K'_2}{K'_s} \times [Ca^{++}] \times [H\,CO_3^-] \quad \text{.Eq. (10)}$$

or

$$pH_s = pK'_2 - pK'_s + pCa + p(H\,CO_3^-) + 9.30 \quad \text{.....Eq. (10a)}$$

This equation is similar to the equation $pH_s = pK'_2 - pK'_s + pCa + p\,Alk.$ as given by Langelier[6] for pH_s below 9.5. Hoover's[7] chart apparently was based on this approximate equation since he also limited its use to waters of pH less than 9.5. If the determination of bicarbonate alkalinity is used instead of total alkalinity, Hoover's chart should not be limited to this range.

Although the theoretical pH_s is an indication of the direction for adjustment of pH, it has no direct significance in itself. It is the Saturation, Index, or $pH - pH_s$, which provides the measure of the stability of the water. With a satisfactory determination of $(CO_3^=)$ alkalinity, the calculations of this Saturation Index I, is even further simplified. It can be seen from equation (9) that for stability there is a definite relationship between the (Ca^{++}) and $(CO_3^=)$ contents of a water.

In other words, too great a concentration of either of these ions would indicate a tendency for the precipitation of $CaCO_3$. On the other hand, a deficiency of either of these ions would indicate an excess of carbonic acid. For the water to become

* $pH_s = pK'_2 - pK'_s + pCa + p\left(Alk + [H^+] - \frac{K_w}{[H^+]}\right) + \log\left(1 + \frac{2K'_2}{[H_s]}\right.$

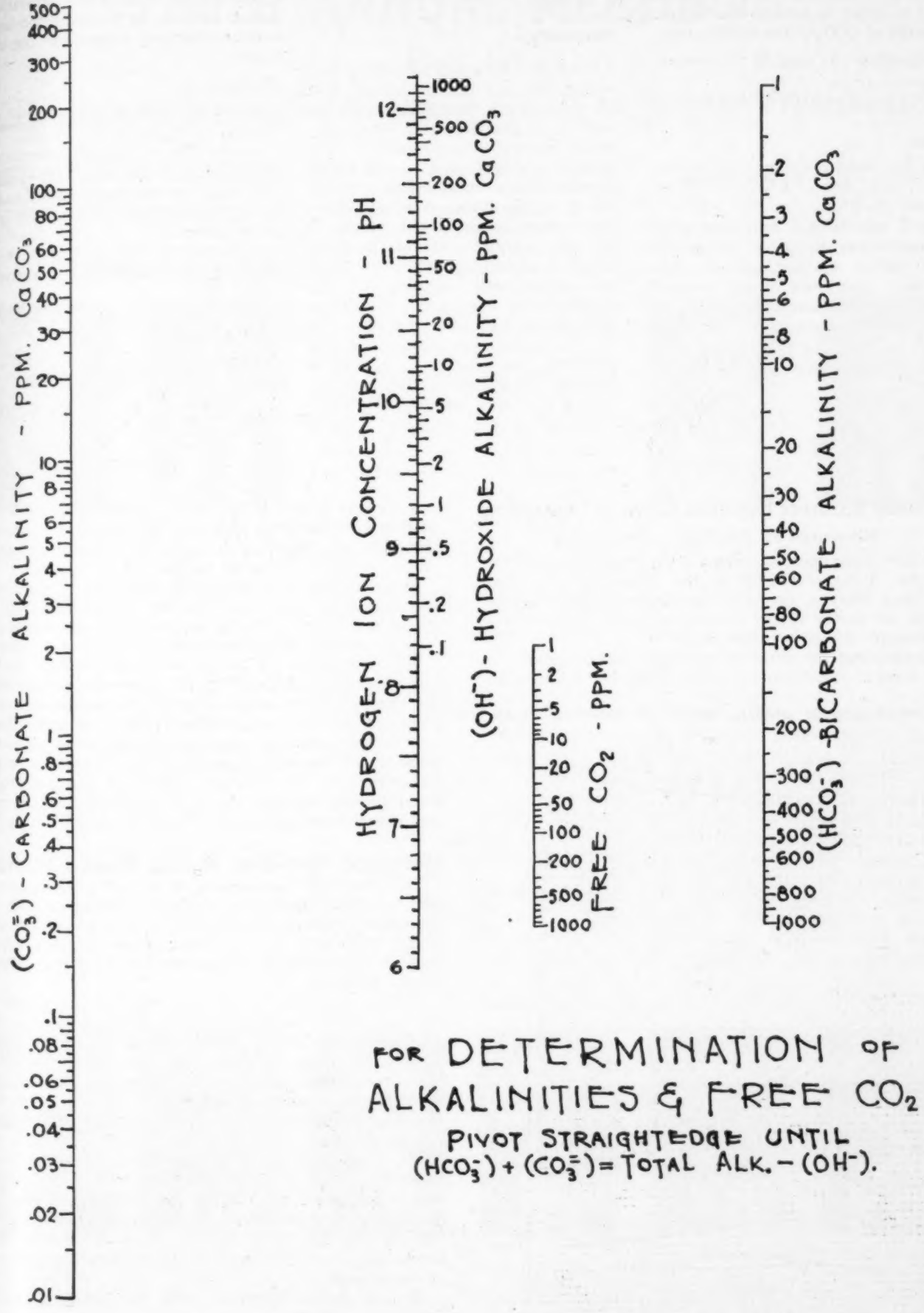


Fig. 1—Nomograph for the Determination of Alkalinities and Free CO_2

stable in a cast iron water main the Fe from the pipe would have to replace the hydrogen in the carbonic acid in order to release the required amount of ($CO_3^=$) for equilibrium.

Equation (9) may be written as

$$\frac{(Ca^{++}) \times (CO_3^=)}{4 \times 10^9 \times K'_3} = \text{Equilibrium Ratio} \quad \text{.....Eq. (11)}$$

or as

$$\frac{(Ca^{++}) \times (CO_3^=)}{\underset{\text{(at 25°C)}}{30.24}} = \text{Equilibrium Ratio} \quad \text{.....Eq. (11a)}$$

(Ca^{++}) and ($CO_3^=$) represent actual concentration in terms of calcium and $CaCO_3$ respectively. A ratio greater than one would indicate scale formation and a ratio less than one would indicate a corrosive water.

To conform to Langelier's Index equation (11) may also be written as

$$I = pK'_3 - 9.60 + \log (Ca^{++}) + \log (CO_3^=) \quad \text{.....Eq. (11b)}$$

where a positive I indicates scale formation and a negative value for I indicates corrosiveness.

Summary

Simplified formulas have been presented for the calculation of free CO_2, carbonate, bicarbonate and hydroxide alkalinities from total alkalinity and pH measurements. The method is not limited to any range of alkalinities, total solids content, pH or temperature. A single alinement chart is presented which allows the determination of the three forms of alkanlinity at 25° C without the cumbersome solution of the simultaneous equations. Simplifications have also been made in the $CaCO_3$ equilibrium concept by considering the direct relationship between the actual calcium and carbonate alkalinity concentrations. Application of the necessary corrections for solids content and temperature to the equilibrium constants rather than to the Saturation Index results in a simplified and more convenient expression for the latter.

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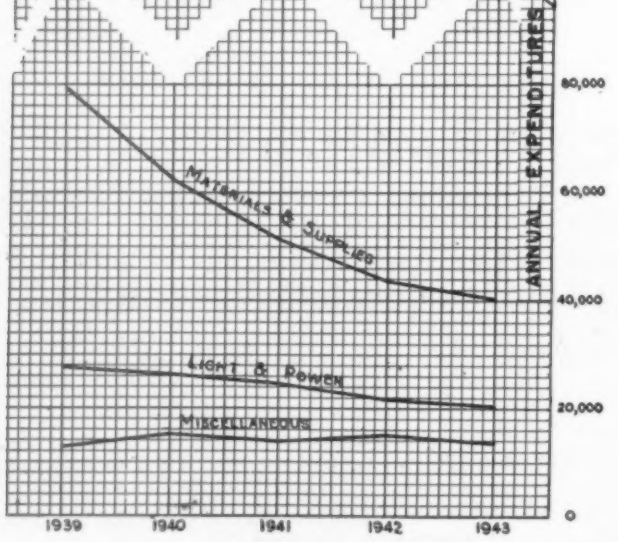
Raising Salaries Reduces Costs of Operation

Minneapolis-St. Paul Report Proves Idea

While space does not permit a complete review of the Annual Report for 1943 of the Minneapolis-St. Paul Sanitary District, one very significant observation does stand out in the report recently released by George J. Schroepfer, Ch. Engr. and Supt.

Reproduced herewith is one chart which appears in the report. Attention is called to the fact that, while salaries and wages in the plant increased $24,775 per year in five years, the total cost of operation (salaries, materials and supplies, light and power, and miscellaneous) actually *decreased* by $20,764 per year.

COMPARISON OF ANNUAL COSTS OF VARIOUS ITEMS



This observation points to the fact that, if plant personnel is adequately rewarded for its services, the response will be evidenced in more efficient operation and reduced general operating costs.

Mr. Schroepfer, in his report, pays tribute to his plant operators and staff in the following words, "For the fine record of accomplishment in maintaining low costs and still further reducing them, your Chief Engineer compliments and expresses his appreciation to the members of the staff from the Plant Operators to the Laborers. . . . To effect economies of the magnitude listed herein requires the full cooperation of a competent and conscientious staff such as we have here."

Maryland Post-War Public Works Manual

The Maryland Commission on Post War Reconstruction and Development has issued a booklet giving the "procedure to be followed by local units of government in Md. when applying for a state grant for the preparation of plans and specifications for Post-War Public Works Projects.

Calling attention to the fact that if the people of the state are to be in position to launch a construction program immediately following the war's end then preparation must be made now, the booklet explains that the General Assembly has passed an Act creating the commission and providing for a state contribution to a municipality of 5 per cent of the cost of engineering plans.

The procedure for obtaining the 5 per cent grant is simple. There are two preliminary steps of application from which the commission will decide whether or not to make the grant. If the grant is offered, the municipality has thirty days in which to conform with three other steps necessary in the preparation of forms of acceptance.

By this action Maryland joins the parade of states which are offering help to municipalities eager and sincere about providing plans for post-war work.

FED. OF SEWAGE WORKS ASSNS.' 16TH ANNUAL MEETING

Part II*

Industrial Waste Problems and Effects on Sewage Treatment

IN Part I it was explained that whereas the meeting of the Federation of Sewage Works Associations, held in Pittsburgh, Oct. 12-14, was only the fifth technical meeting it was actually the sixteenth annual meeting of the Federation Board of Control which voted, because of the age of the Federation, to designate the 1944 meeting as the sixteenth rather than the fifth.

Penna. Assoc.

Fed. Director
F. S. Friel
Cons. Engr.
Philadelphia

Secy.-Treas.
Bernard S. Bush
Dist. Engr.
Pa. Health Dept.
Wilkes-Barre, Pa.

Because of space limitation in the Nov. issue the first installment of this report was incomplete, there being two papers unreported. It has also been brought to our attention by one of our friends that in our report on the demonstration of safety equipment and its use in combating the hazards of oxygen deficiency and noxious gases, we failed completely to mention the use of the multi-purpose portable gasoline-engine driven blower to supply fresh air; these little blowers in so conspicuous evidence at every manhole of electric and gas companies where men are at work. On sewers and at treatment plants they are seen far less frequently than should be the case.

We felt it worth the space to call attention to the omission inasmuch as at the safety session, the use of blowers to furnish fresh air and ventilation was recommended as standard equipment by the Federation Committee on Occupational Hazards.

*Concluding installment. Part I is to be found in our November number.

Final Settling Tank Design

Speaking on the "Design of Final Settling Tanks for Activated Sludge," **Norval E. Anderson,** Engineer of Treatment Plant Design, of the Sanitary District of Chicago, said that his comments were limited to the activated sludge process because it is there only, that the phenomenon of "density currents" exist in final tanks.

"These density currents have an important effect on the performance of settling tanks. . . . A density current is a gravity flow produced in one fluid by another of slightly greater density seeking the lower level. This happens when mixed liquor of an activated sludge plant enters final settling tanks." (This reporter has observed a similar action in primary settling tanks although Mr. Anderson says it is limited to activated sludge.)

In the case of activated sludge, "apparently the mixed liquor is such an intimate suspension of flocculent solids that it acts as a liquid of greater density than water. This causes the mixed liquor influent to plunge to the bottom of the tank and flow along the bottom until deflected upward by some obstruction (e.g. the end of the tank), thereby inducing a counter-current in the upper level back toward the influent."

By means of lantern slides the speaker showed the course of these density currents, and pointed out that the velocity of the density current appears to be affected by the tank proportions and the inlet velocity. The discovery of these density currents was made during a series of tests at the Southwest Sewage

President WSMMA
C. A. McGinnis
Mgr. Transite Pipe, J-M
New York

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Federation Directors

Georgia
Van P. Enloe
Supt. of Sewage
Atlanta, Ga.

Md.-Del.
A. L. Genter
Cons. Engr.
Baltimore, Md.

Rocky Mt.
Dana Kepner
Mfgrs. Repr.
Denver, Colo.

At Large
Frank Lovett
Engineer
Link-Belt Co.
Chicago, Ill.

New Jersey
E. P. Molitor
Supt. of Sewage
Chatham, N. J.

Cent. States
B. A. Poole, Maj.
Corps of Engrs.
Washington, D. C.

(These three received Kenneth Allen Awards)

Departments of Health

U.S.P.H.S.	Florida	Penna.	New York	Indiana
C. C. Ruchhoft	*F. A. Eidaness*	*H. E. Moses*	*W. H. Larkin*	*J. L. Quinn, Jr.*
Prin. Chemist	*San. Engr.*	*Ch. Engr.*	*Dist. San. Engr.*	*Act. Dir. San. Div.*
Cincinnati	*Jacksonville*	*Harrisburg*	*New York City*	*Indianapolis*

Treatment Works in Chicago in 1940.

On the matter of tank rate, Mr. Anderson said, "The customary surface rating factors for design capacity appear to be satisfactory insofar as they go but the most conservative rating will not assure good performance if other details of design are not correct." For example the question of tank depth "deserves more than casual mention. Apparently there should be a limiting ratio between flow length or distance from inlet to upturn of density current, and the tank depth." While data are not sufficient at the present to fix this limiting ratio, Mr. Anderson hazarded an opinion that, "for circular tanks, with center inlet, the radius should not exceed five times the side water depth;" for rectangular tanks the length should be "about seven times the depth;" and effluent wiers or launders should be at least ten ft. above the floor of the tank, or 12 ft. if the wiers are located at the upturn of the density current.

Other observations on this subject were (1) no type of baffle in the inlet arrangement has any effect on the quality of effluent (25 arrangements were tried); (2) mixed liquor should be introduced as gently or "at as low velocity as possible without dependence on baffles"; (3) high winds (in 126 ft. tanks) produce an overturning current, "which raises more floc on the windward side but causes more flow over the effluent wiers on the leeward side with less floc, so that the final effluent is apparently little affected."

Of particular interest were Mr. Anderson's comments on the location of effluent weirs. "Two factors are involved in the design of effluent weirs, location and length, or weir rate and these are interrelated. A higher rate may be used for weirs located away from the upturn of the density current than for weirs located at or near the upturn."

Early experiments conducted before the existence and action of the density currents were known, showed that effluent weirs located away from the effluent end of a tank gave better results than the normal tank design. The location of weirs was thoroughly studied under controlled conditions in tanks 126 ft. in dia., and the following results were obtained.

Tank Construction	Overflow Rate gpd. per ft. of Weir Length	Susp. Solids in Effluent ppm.
Two concentric weir troughs 15 and 25 ft. from the outside wall	9,900	10.6
One concentric weir trough 15 ft. from outside wall	17,700	13.8
Peripheral weir	28,200	13.2

It was Mr. Anderson's opinion that for weirs located away from the upturn of the density current, the over flow rate should not exceed 20,000 gpd. per ft. of weir and for weirs located within the upturn zone the rate should not be more than three fourths that amount. This would limit circular tanks with center feed and peripheral weirs to a diameter of 80 ft. or so at customary surface ratings.

"The inherent economy of the circular tank design, however, may be carried into large sizes by providing effluent weir troughs carried on cantilever brackets from the walls." This design has been developed at Chicago for 16 additional final tanks which are awaiting completion until the end of the war. Three ft. effluent troughs are located 12 ft. in from the peripheral wall, the effluent spilling into the collector ring from both sides.

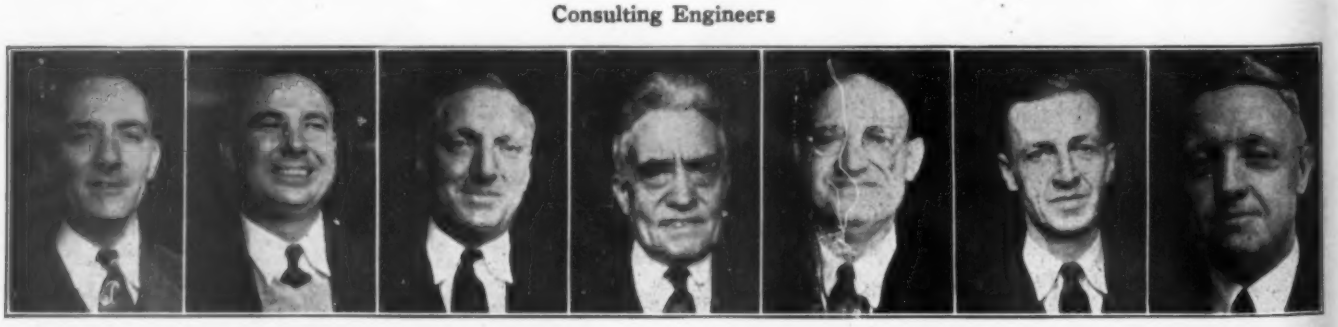
There seems to be a great deal of latitude in the location of the weirs other than directly above the influent or in zone of upturn of the density current. Between these extremes, however, good results seem to be uniformly obtained.

Mr. Anderson also commented on the matter of sludge draw-off mentioning that two desired results are quick removal to maintain freshness of sludge, and concentration of sludge solids.

The greatest factor in maintaining sludge freshness is the depth of sludge blanket or detention period, and most plant operators have learned to carry as little sludge as is practical in the final tanks.

After presenting data on the lack of movement of the sludge blanket in the direction of the density current, and the results of two experimental tests indicating that the freshness of the sludge is determined by the rate or per cent of sludge return rather than tank design, the speaker said that it appeared preferable for the point of sludge draw-off to be located near the tank inlet.

Consulting Engineers



W. D. Williams	*B. F. Borden*	*L. G. Williams*	*Almon L. Fales*	*F. M. Veatch*	*T. R. Hazeltine*	*M. G. Mansfield*
Morris Knowles, Inc.	*Smith & Gillespie*	*Greely & Hansen*	*Metcalf & Eddy*	*Black & Veatch*	*The Chester Engineers*	*Morris Knowles, Inc.*
Pittsburgh, Pa.	*Jacksonville, Fla.*	*Norfolk, Va.*	*Boston, Mass.*	*Kansas City, Mo.*	*Pittsburgh, Pa.*	*Pittsburgh, Pa.*

One-third of the Canadian Contingent

R. H. Parsons, City Engr., Peterborough, Ont. — *Geo. Phelps, Engr. of Sewers, Toronto, Ont.* — *W. H. Collins, Dep. City Engr., Hamilton, Ont.* — *J. D. Daly, Mgr. Editor, Eng. & Cont. Record, Toronto, Ont.* — *W. L. McFaul, City Engr., Hamilton, Ont.*

Similarities of Bio- and Standard Filter Slimes

After a protracted study of the films in standard filters and those in bio-filters, **Dr. H. Heukelekian** arrived at the conclusion that the only essential difference was quantitative, not qualitative, both perform on the principle of Colloidal absorption. This conclusion came as the result of 22 analyses of slimes in a bio-filter and 17 analyses of the film in a standard filter.

These analyses consisted of determinations of ash, B.O.D., grease, and total solids at different levels of each filter at different times of the year. Analyses were made, not of the change in composition of the sewage passing through the filters but in the change in composition of the biological film through the filters. As a reference point the analysis of the top layer of film was used.

Ash was found to increase through each filter from top to bottom, but the greatest change was in the first foot of depth. The B.O.D. decreases but not markedly. Nitrogen content decreases slowly through the filter with the bio-filter showing the greater decrease. The nitrogen and B.O.D. contents of the film were found to be higher than that of activated sludge.

The ash content shows a higher rate of increase in winter than in summer, with the standard filter being the greater. The whole bed appears to be used in winter whereas in the summer the upper layers perform the greatest part of the purification process.

The grease content of the bio-filter film goes up in the winter, but the standard filter has a low grease content both summer and winter. The Nitrifying capacity appears to be greatest at the top of the bed in both cases.

Types of organisms are about the same in both filters and while the flagellate are more numerous in the bio-filter, the ciliates and rhizopods are approximately the same.

Symposium on Industrial Wastes

Under the leadership of **Dr. F. W. Mohlman,** Dir. of Laboratories of the Sanitary District of Chicago, one session was devoted to symposium on industrial wastes. In opening the session, Dr. Mohlman said that we may expect a change in attitude toward industrial wastes after the war. Industry should evaluate its wastes, salvage those of value, treat the irrecoverable, ascertain the capacity of the receiving body of water and discharge no more pollution load than the stream can stand.

Treatment of Packing House Wastes with particular reference to two plants was the subject of a paper by **K. V. Hill,** Partner, Greeley and Hansen, Engrs., Chicago. With an annual kill of approximately 31 billion pounds of animals exclusive of government kill, the waste produced is approximately 31 billion gal., with a population equivalent of 11,200,000.

There have been huge increases in kill in the last fifteen years and this has added to the problem of sewage treatment plants trying to handle the wastes. The effect is greatest in medium sized cities. Not only are the quantities of waste large, but

Two Supers and a Soldier

L. C. Billings, Supt. Sew. Tr., Dallas, Tex. — *H. T. Rudgal, Supt. Sew. Tr., Kenosha, Wis.* — *Maj. F. D. Stewart, Ch. San. Br., Hq. 5th Sv. Corps, Columbus, O.*

they are variable, and not only does the quantity vary seasonally, but the strength likewise varies. The volume of waste per unit kill varies from 835 to 4160 gal. and averages 1600 gal. Seasonal variations in volume and strength are complicated by hourly and daily variations as well.

There is no general method of treatment and probably will be none until a paying recovery process is found, but at present paunch manure seldom goes into the sewers, and blood recovery is quite generally practiced.

At Austin, Minn., the waste is treated by plain sedimentation followed by chlorination and sedimentation. Using some 3500-4500 lb. of chlorine a day, the suspended solids are reduced from 4½ to 2½ lb. per 1000 lb. of kill, and the B.O.D. is also reduced leaving the city sewage plant with not too much to do to this particular waste.

At Sioux Falls, S. D., the activated sludge process is used in the sewage plant and trickling filters are used. The return of activated sludge seems to reduce the grease content. Removals have been good in the filters, particularly good in winter since the installation of rotary distributors.

Treatment of Oil Industry Wastes is not a problem to many municipalities but it is a terrific problem where it exists according to **W. B. Hart,** Supt., Gas, Acid and Drainage Dept., The Atlantic Refining Co., Philadelphia, Pa.

Oil wastes are divided into four categories depending on whether they come from the production, refining, marketing, or transportation divisions of the oil industry. Wastes from production are generally emulsions, and drilling muds along with brine, the latter of which is usually disposed of in the ground or the sea. Wastes from marketing and transportation divisions are usually only spillages, or emulsions.

Refinery wastes are the most numerous and the most complex. The number of wastes is the mathematical product of the number of crude oils refined times the number of processes employed. These wastes include brines, free and emulsified oils, taste and odor producers, oxygen consumers, toxic, acid, or alkaline substances, and color producers.

In a thorough-going manner Mr. Hart proceeded to tell his audience how the Petroleum industry proceeds with the attack on any of these types of wastes; what treatments are, can be, or have been developed; how the experiments are taken from the laboratory to the pilot plant and then how the treatment is applied to the full plan scale waste.

After the adoption of a waste treatment, a stream survey is in order to ascertain if the desired result

has been accomplished. "Thereafter," said Mr. Hart, "it is necessary to see that the plant is operated efficiently, and properly. This takes care, it takes maintenance, it takes proper operation, and it takes checking."

While the policies and problems vary as do the individual oil companies, the American Petroleum Institute through its manuals has aided materially in the solution of many of the oil industry problems.

Florida's Citrus Canning Waste Disposal Problem was described by **Dr. Robt. S. Ingols,** Schools of Pub. Health, Univ. of Michigan (formerly Research Fellow, Florida Citrus Comm., U. S. Dept. Agr.).

Wash water and process water are the two sources of waste in this industry, both of which can be solved by sanitary methods of treatment, but while the problem exists the year around, there is no treatment inexpensive enough to make it economically feasible for individual canners.

The most common method of treatment now is to discharge the waste into lakes or truck it into swamps inasmuch as there are no streams available. Some wastes are disposed of on sand, some into the city sewers where possible. Lagooning is used as is discharge into wells in the ground. The latter method is fraught with some danger inasmuch as in one city, this practice by virtue of digestion of the waste, has resulted in the production of a vast reservoir of methane gas beneath the city.

Alcoholic production from the citrus molasses is not feasible as a waste treatment method because there is still the beer slop waste to dispose of. Production of yeasts likewise leaves a waste and financial return is too low.

The problem remains severe and while not impossible of solution from the standpoint of sanitary engineering and chemistry, it is not readily solvable from the standpoint of economics.

Treatment of Some Chemical Industry Wastes was the story of the operation of the waste treatment processes of the Dow Chemical Co. at Midland, Mich. It was told and shown by **Thomas J. Powers,** Head of the Industrial Waste Dept. of the Dow Chem. Co.

Not only was this story of particular interest in its description of the operation of a combination lagoon, trickling filter, and activated sludge plant on phenol and other wastes but the method of presentation of the paper was entirely new, unique and interest holding throughout. The author was roundly complimented on his contribution which set a mark for future programmers.

In introducing this new method of presenting a paper Mr. Powers had obviously spent considerable time and effort to bring to the audience a clear conception of how the problem of waste treatment is met at Midland.

Using a color–motion picture, which showed each step in the process clearly, Mr. Powers narrated a special scripted version of his paper to accompany the picture as it progressed. Then, in order that the audience might fully comprehend the efficiency and operation of each part of the plant as shown, there were thrown on the screen (superimposed beneath the center of the picture) the data on operation. These figures remained in view a sufficient length of time for easy comprehension, while the narrator commented on the salient portions of the data.

Important factors in the success of the treatment plant are first, the hourly tests for phenol and acid, which show the strength of the incoming waste, and secondly, the large lagoon into which exceptionally high concentration wastes are discharged to be removed slowly and mixed with weaker wastes as these are received.

The size of the trickling filter plant is dependent on its winter capacity, which is but 50 per cent of what it is in the summer. The addition of an activated sludge process to operate in supplementing the work of the rugged filters greatly increased the capacity of the plant, a necessity brought on by the war. Last year over 4000 lbs. of phenol were being removed each day by the operation of this plant, and even this impressive rate has increased in the past several months.

Two thirds of the phenol is removed in the filters and essentially the other third by the activated sludge process. If strong shots of wastes escape the operator's tests it is possible to shunt out any part of the plant and, by utilizing the lagoon, allow the process to recover from the shock. Large lagoons are also used for some of the dye and brine wastes and the effluent from the phenol treatment plant also goes into a large lagoon before entering the nearby river.

Industrial Wastes in Connecticut was the subject of a paper by **Wm. S. Wise,** Chief Engr., State Water Commission, Hartford, Conn. Mr. Wise said that in considering industrial wastes any political or administrative body must have a program which takes cognizance of the degree of treatment justified, which in turn is dependent on the economic balance versus the stream use. The goal of such a program must be to maintain a reasonable use of the stream, with conservation of water, and utilization of self purification both working toward the same end—i.e., use, but not abuse of streams. Rigid standards can not be set for any state, region, or country but must depend on the stream itself.

Mr. Wise outlined the classification of most of the industries in Con-

More Federation Directors

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Pasadena	*Wash. Dept. Health*	*San Antonio*	*Columbus*	*Kitchener*	*N. D. Dept. Health*	*Worcester, Mass.*
	Seattle				*Minot, N. D.*	

necticut, mentioning in particular, metallurgical wastes, paper mill wastes, pickling liquors, textile wastes. Each waste presents a different problem in each stream and the treatment may therefore be different in different places. Mr. Wise discussed many of the problems, and the methods and limitations thereof considered in the present lines of attack.

Ambassadors of Commerce

P. F. T.'s Len Langford East. Mgr. New York — *Eimco's Paul Richter Mgr. Filt. Div. Chicago W. & T.'s* — *H. S. Hutton Sales Mgr. Newark, N. J. New York* — *Dorr's A. J. Fischer Dev. Engr. Columbus* — *Jeffry's Sam Tolman Mgr. San. Sales*

Mr. Wise's paper indicated a comprehensive and well organized program both for study and abatement of pollution in Connecticut and one which would be of value to anyone interested in the general problem.

Effects of Industrial Waste Loads Subject of Operator's Forum

Under the leadership of **Christian L. Siebert,** Exec. Engr., San. Water Board, Pa. Dept. of Health, Harrisburg, the annual Operator's Breakfast Forum this year was devoted to the "Effects of Increased Industrial Waste Loads on Sewage Treatment Processes."

Don E. Bloodgood, Assoc. Prof. of Civ. Engr., Purdue Univ., noted from a study of five cities in Indiana, there had been a definite increase in sewage flow per capita, caused undoubtedly by industrial wastes and that with the increase in flow there had been an increase in suspended solids concentrations and content.

Reuben F. Brown, Supt. of Sewer Maintenance, City of Los Angeles, told of the difficulties caused by cutting oils when mixed with other greases in the Los Angeles sewage. Clogged grease traps, scum, and grease slicks at the outfall discharge were all noticeably increased. Efforts are made to solve the problem by permits and regulation, at the same time bearing in mind that such problems require analytical study and cooperation with the industry involved. Adoption of service charges and reclamation have been considered.

John Zymanski, Supt. of Sewage Treatment at New Britain, Conn., reported considerable increase in oil and grease accumulations caused by the introduction of increased amounts of cutting oils into the sewers.

Roy Lanphear, Supervising Chemist, Sewage Treatment Plant, Worcester, Mass., has observed large increases in the amounts of acid-iron wastes from pickling liquor discharges. The particular problem and its solution in Worcester is complicated by three facts, (1) it is of a temporary nature and is expected to be eased when the war is over, (2) a 53-year precedent in which the industries have discharged wastes into the sewers does not make it easy to insist now that industry remove the waste from the sewer; and (3) while treatment processes have deteriorated, structures have not. Thus any cooperative solution of the problem does not seem possible at the present.

Sol Seid, Supt., New Brunswick, N. J., told of the recent increase of five tons per day of ferrous sulfate in their sewage. The City of New Brunswick has an ordinance which sets up charges for industrial wastes on the following rate

Programmers

K. V. Hill Greeley & Hansen Cons. Engrs. Chicago, Ill. — *C. L. Siebert Exec. Engr. Pa. Dept. Health Harrisburg, Pa.*

Don E. Bloodgood Assoc. Professor Civil Engineering Purdue Univ. Lafayette, Ind.

base: $22 per mil. gal., plus $5 per ton of suspended solids, and an additional $5 per 100 lb. of chlorine demand. The rate involves careful representative measurement, sampling and analysis of the wastes leaving the several contributing plants.

T. C. Scheatzle, Engineer-Chemist, Sewage Treatment Plant, Akron, Ohio, has had his share of problems with the synthetic rubber industry. With a treatment plant designed for handling 25 tons of solids per day, he now finds the load to be 80 tons daily. Naturally the removals have dropped and lagoons are used as much as possible. One of the problems results from the fact that a goodly portion of the synthetic rubber "crumbles" have a specific gravity of practically 1.0 and will not settle. Another is the heavy discharge of oil at times, and another is the carbon black. Cooperation by the industry was praised by Mr. Schaetzle.

Robert M. Bolenius, Chemist, Sewage Treatment Works, Lancaster, Pa., has observed that certain oxidizing oils are not beneficial to operation of his activated sludge process.

L. D. Matter, Penn. State Dept. of Health observed that one of the reasons for the increase in cutting oils was the large number of small shops which paid no attention to their wastes, and the discontinuance of the collection of garage oil in Lancaster.

Harry W. Gehm, Technical Advisor, National Council for Stream Improvement, explained how paper mill wastes could be reduced by adoption of the closed or partially closed flow system, in many instances at a benefit to the mill. The Nat. Council has a large program under way to effect greater improvement in streams by the treatment of paper mill wastes and for reuse of the so-called white water.

W. T. Knowlton, Cons. Engr., Los Angeles, had his short paper read by Wm. Allen of Pasadena. Mr. Knowlton's comments were on the subject of increases in fish oils and sardine waste particularly at Los Angeles Terminal Island Plant, where the suspended solids content of the sewage is 25 per cent above the average for the country normally and far above that in the canning season.

Time did not permit the discussion of the scheduled committee report on "Operators' Qualifications" which was carried forward to the next meeting, and we regret that space does not permit a fuller report on the Operators' Forum.

THE SANITARY ENGINEERING DIVISION OF THE USPHS

An Endeavor to Give Our Readers a Bird's-Eye View of the Work and Organization of the Revamped and Impressively Amplified Engineering Division of the Public Health Service

WITH the adoption on July 1, 1944, of the Public Health Service Act, codifying all laws pertaining to the U. S. Public Health Service and repealing those which were obsolete, the reorganization of the Service became complete.

The Public Health Service is one of the constituent units of the Federal Security Agency. The Surgeon General, designated by the President with Senate approval, administers the affairs of the organization. There is in the Service a commissioned Regular Corps of medical, dental, and engineer officers and, for duty in time of emergency, a commissioned Reserve Corps. All commissioned officers are appointed without regard to civil service laws and have grades, pay, and allowances corresponding to those of officers of the Army.

Provision for the reorganization of the Public Health Service was made with the enactment on Nov. 11, 1943, of Public Law 184, the provisions of which were incorporated in Public Law 410 of July 1, 1944, referred to above as the Public Health Service Act.

This legislation reorganized the Service into four principal administrative divisions: Office of the Surgeon General, the National Institute of Health, the Bureau of Medical Services, and the Bureau of State Services. The Surgeon General is authorized to appoint a commissioned officer of the Regular Corps as the Chief Sanitary Engineer Officer of the Service, such officer to have the title of Assistant Surgeon General. Sanitary Engineer Director J. K. Hoskins, with the commissioned rank of Rear Admiral, was designated for this duty, in charge of the Sanitary Engineering Division in the Office of the Surgeon General.

On December 30, 1943, Reorganization Order No. 1 was issued by the Surgeon General with the approval of the Administrator of the Federal Security Agency. This order reads in part as follows:

"(d) *Sanitary Engineering Division.* This Division will have general supervision over all sanitary engineering and sanitation operations carried on by the Public Health Service, and professional supervision over all sanitary engineering personnel of the Public Health Service including personnel assigned for duty with other governmental agencies. The Chief of the Sanitary Engineering Division will advise the Surgeon General regarding plans, programs, and policies for the Public Health Service in relation to sanitary engineering and sanitation activities, including standards for sanitary engineering and sanitation practices, standards for sanitary engineering and sanitation personnel, and projects for sanitary engineering and sanitation research. The functions of the Sanitation Section in the Division of Domestic Quarantine (States Relations) and of the Stream Pollution Laboratory at Cincinnati, Ohio, in the National Institute of Health are transferred to this Division."

Organization of the Division Of Sanitary Engineering

For the organization of the Engineering Division, sections were established, each in charge of an engineer officer, dealing with General Sanitation, Milk and Food, Vessel Sanitation, Water and Sewage, Sanitation Facilities, Facility Security, and Personnel, Property and Accounts. The executive officer of the Division acts as assistant to the Chief and also serves as a liaison with other Service bureaus, divisions, and district offices, as well as with other governmental agencies and departments in matters dealing with personnel assignments and sanitary engineering programs and activities. The function of the various sections of the Division are briefly described in the following paragraphs.

General Sanitation Section.—This section is concerned with sanitation of interstate carriers, administrative responsibility with respect to policies and procedures in shellfish sanitation certification, problems of refuse and garbage disposal referred to it by the State and local officials and district field staffs, control of interstate shipment of shaving brushes to prevent spread of anthrax through this medium, and the preparation of Public Health Engineering Abstracts.

During the past year, 1500 water supplies and 2500 watering points were considered for certification. A manual for the sanitary control of the shellfish industry is in process of final revision. Amendments 7 and 8 to the Interstate Quarantine Regulations were prepared and adopted in the past year. The former pertains to shaving brush manufacturers' plants operating in interstate traffic and the latter controls the interstate shipment of garbage used for hog feeding.

Milk and Food Section.—This section is responsible for the programs and policies of the Public Health Service on milk and food sanitation. The interest in restaurant and food sanitation is indicated by the fact that the Ordinance and Code Regulating Eating and Drinking Establishments Recommended by the Service is now in effect in 11 entire states, and in 108 counties, and 177 municipalities located in 25 other states; it has also been adopted as state regulations in 11 additional states.

Water Supply and Sewerage

Water and Sewage Section.—The principal activity of this section has been the development of manuals and standards. In the past few years it has assisted in the preparation of the following: Drinking Water Standards, September 1942; Sanitation Manual for Land and Air Conveyances Operating in Interstate Traffic, 1943; Emergency Minimum Sanitation Standards, 1943; Sanitation Manual for Public Ground Water Supplies, 1944.

The section has been active also in assisting in the development of the Recommendations of the Joint Committee on Rural Sanitation (an interdepartmental committee of Federal agencies) concerning Rural Sewage Disposal. The Conference of State Sanitary Engineers is also represented on the committee.

Sanitation Facilities Section.—During the war period, the Service, through this section, has acted as an adviser to the Federal Works Agency and the War Production Board in the provision of Federal aid for adequate public water supplies, sewerage, and other essential sanitation

facilities in military and war industry areas. This activity has necessitated extensive field surveys to determine essential needs for the protection of the public health and for the maintenance of the war effort.

The FWA, out of a Lanham Act appropriation totaling $415,000,000, has provided approximately $125,000,000 in direct Federal construction and in grants or loans to local agencies for 362 water supply projects, 354 sewerage and sewage treatment projects, and 30 miscellaneous sanitation projects. These 746 projects have an estimated construction cost of almost $156,000,000. At the end of the fiscal year, 521 of these projects with a total estimated cost of over $84,000,000, were in operation or substantially completed.

Vessel Sanitation Section.—Specifications of the U. S. Maritime Commission require that the drinking and culinary water supply and ratproofing of all vessels constructed under the supervision of that agency must carry an approval certificate of the Public Health Service. Plans of new vessels are accordingly reviewed by the Vessel Sanitation Section to detect defects in design of these features and during construction the vessels are inspected before approval certificates are issued. A vessel sanitation manual has been prepared and issued covering the features that are required to be provided to merit certification.

Facility Security Section.—This program was developed in accordance with provisions of Executive Order 9165, designed to provide protection for, and adequacy of public facilities serving military and war industry areas. Special emphasis was placed on the correction of sanitary defects, defects in plant operation and plant needs. In a program to insure a continuous, safe, and adequate supply of water to essential war industries, the three items mentioned appeared to be equally if not more important than defects in sabotage protection. Activities of the State health departments and water works groups prior to 1943 on sabotage protection reduced to a considerable extent the necessity for special activities of the Service on this phase of the program. Inspection was limited to those water facilities serving essential or important war industries with high priorities. In this category 646 facilities were inspected and recommendations relative to correction made where necessary. State health departments were furnished complete records of the facilities inspected in their States and are in a position to continue that part of the program pertaining to correction defects.

Engineer Staff Has Become Impressive

Personnel, Property and Accounts Section.—This section recruits engineering and sanitation personnel for the Service, processes applications for examination, appointment and promotion of engineering personnel (for the Regular and Reserve Corps Boards). On July 1, 1944, the engineering and sanitation personnel of the Public Health Service numbered 490. Of these, 38 were commissioned sanitary engineer officers of the Regular Corps, 326 were commissioned personnel in the Reserve Corps, and 126 were civil service sanitation personnel.

The section is also responsible for the preparation of budgets, payrolls, and all fiscal and property matters necessary for the operation of activities of the Engineering Division.

Water and Sanitation Investigations Station

The general research program of the Water and Sanitation Investigation Station in the past several years has been concerned to a very large extent with problems of water and liquid wastes sanitation connected with the war effort. The work projects fall into one or more of the following categories: (1) Statistical inventory of sanitation works, (2) stream pollution and sanitation problems, (3) problems of water supply treatment, (4) sewage and industrial wastes, (5) emergency health and sanitation, (6) milk and food laboratory practice, (7) miscellaneous activities.

The major activity of the station concerned with stream pollution problems in the past year or two has been collaboration with the U. S. Engineer Corps in carrying out studies of the value of low water stream flow control in connection with projects of the Engineer Corps for the construction of flood control and multiple-use storage reservoirs in certain river basins. The past year has been marked by the appearance of the final printed report of the Ohio River Pollution Survey as House Document 266.

During the past year a trained bacteriologist has been engaged in promoting improvement of sanitation laboratory methods and procedures followed in the various states. Standard check rating forms have been developed for milk examination and water examination methods. This form has been used in surveys carried on in Districts 3 and 7, and the milk form has been adopted as a standard by the American Public Health Association.

Under the Emergency Health and Sanitation Activities program of the Service, the station has continued its work of operating six mobile laboratory units. Five of the laboratories, assigned to the districts, are engaged in supporting local sanitation programs, in military and naval training camp areas and in war industrial areas, largely concerned with water and milk supplies and food purveying establishments. The sixth unit is engaged in field studies of liquid wastes from newer types of war industries concerning which no definite information was available when these industries were established.

Some Post-War Planning Endeavors

In connection with post-war planning, the Engineering Division has continued the work started by the former Sanitation Section of the States Relation Division on a National Inventory of Needs for Sanitation Facilities. The Cincinnati Station has assisted materially in the preparation and assembly of material for the inventory. To date, the following sections have been published and released in Public Health Reports:

(1) Public Water Supply
(2) Milk Pasteurization Facilities
(3) Sewerage and Pollution Abatement
(4) Rural Sanitation

During the war period and for a year prior to December 7, 1941, comprehensive surveys of existing health, housing and sanitation facilities in military and industrial defense areas have been conducted by personnel of the district offices. The information in these survey reports is compiled in the Division and serves as the basis for preparation and justification of estimates for emergency health and sanitation activities before the Federal Security Agency, the Bureau of the Budget, and Congressional committees. Assignments of public health workers to the district offices and to state health departments are made to a considerable extent on the justification and need for them indicated in the survey reports. The information contained in the surveys regarding community facility needs, such as water supply, sewerage, hospitals, and other public health requirements, is also utilized by various governmental agencies in connection with their activities.

The Editor's Comments

Amen, Brother!

OUR older readers will perhaps recall an outburst on this page a few years back which was captioned "Speakers Who Talk Too Long."

There was a lot of deep feeling expressed in that editorial, and from a number of readers we received commendation for having spoken plainly against the abuse of a privilege and disregard by some speakers for their fellow programmers who must follow, and their utter lack of appreciation for their audience and lack of regard for the chairman of the session who is, in truth, expected to keep the program reasonably on schedule without having to resort to strong-arm methods in so doing.

Strangely enough there are two extremes in the classes of speakers who seem to have the least terminal facilities when speaking or reading papers. These are the inexperienced programmers (frequently without tuition) and the most erudite amongst those in the classification of researchers, teachers and professors. The inexperienced man can be excused in a good measure and really deserves assistance from the program committee in the direction of picking the real meat from his paper and marking it for reading. The educated programmer cannot be excused, and in particular the experienced class lecturer who has knowledge of what can be covered in an allotted time period when speaking or reading. The inexperienced man has difficulty with composition, he begins too far back in leading up to the real points of interest and importance in his paper, he repeats, and is apt to leave the script in some aside explanations and lose his place, himself, and his audience in so doing. In his enthusiasm (and nervousness) he completely loses track of time. His plight is appreciated by many, and all that he needs is assistance in the great majority of cases. Even the chairman can help by watching the pages of his manuscript and guiding him as to minutes remaining to complete his allotted time for presentation.

As to the more erudite and experienced authors and speakers, all that they need is a consideration for all concerned and a realization that they are expected to hold to the time allotted on the program. They cannot be excused, for they know how to prepare a reading script representing a highlighting of their papers, or the marking of their manuscript, indicating portions to be read.

All in all, there is no excuse for such men if they abuse their privilege, steal other speakers' time, and weary their audience. The chairman should see to it that this doesn't happen. It is not a pleasant duty to remind a speaker that he is running close to his time limit when he is apparently hell bent on getting everything read that he thinks of interest. But, that is really the job that a good chairman assumes, as well as accepting a seat of honor through presiding.

As regards chairmanships, it has long been the contention of this writer that there should be two chairmen for each program. There can be the appointed or elected chairman for the sake of the honor, but the sessions should actually be run by what might be called a professional chairman or managing chairman. He would be the experienced "director" of the session, holding speakers to scheduled time, stimulating discussion and directing it, then cutting it off at the right time. We don't think this thought too far fetched, the only problem being enough "professional chairmen" willing to serve without compensation.

Now what brought on this second outburst against "Speakers Who Talk Too Long" (and chairmen who let them) was a letter to the editor which voiced opinions virtually expressed by others who suffered at the same meeting. The writer of the letter suffered as a program participant who found his audience completely chair weary and smoke dazed in an overtime session, at the end of which he was expected to rush through with a splendidly prepared and unique presentation which set a new mark. The following is quoted from his letter—and is well put:

"This is my first 'letter to the editor.' Heretofore, I have classed the writers of 'letters to the editor' as cranks or crackpots. Perhaps I can qualify in that category.

"The axe I wish to grind might be entitled 'Presentation of Conference Papers.'

"Those responsible for a conference program try to solicit papers which will prove interesting, informative and timely. If a person accepts an invitation to present a paper, he should also be prepared to accept the rules of any conference relative to its presentation.

"Papers written for publication can very seldom be successfully read to any group. Therefore, it is necessary frequently to prepare two papers, one for publication and one for reading. The paper for publication will be edited by competent persons before being seen in print. The paper for reading is entirely the author's responsibility and requires the most attention. This paper should be written, read, rewritten and read until the author can present his story in the time allowed or less.

"Any person who takes up more time to present his paper than is scheduled is guilty of gross negligence and impoliteness. He places the chairman of the session in an embarrassing position and usurps the time of succeeding papers. He steals from the conference valuable question and discussion time and generally lowers his own standing.

"In presentation, a picture on a slide or a large chart may tell more than detailed description. The author should improvise, summarize and practice delivery so that the presentation is worthy of the subject. A concise paper confined to the subject is essential.

"Any person who feels he is too busy or too important to take the time to prepare for proper presentation should not accept the invitation to appear on any program.

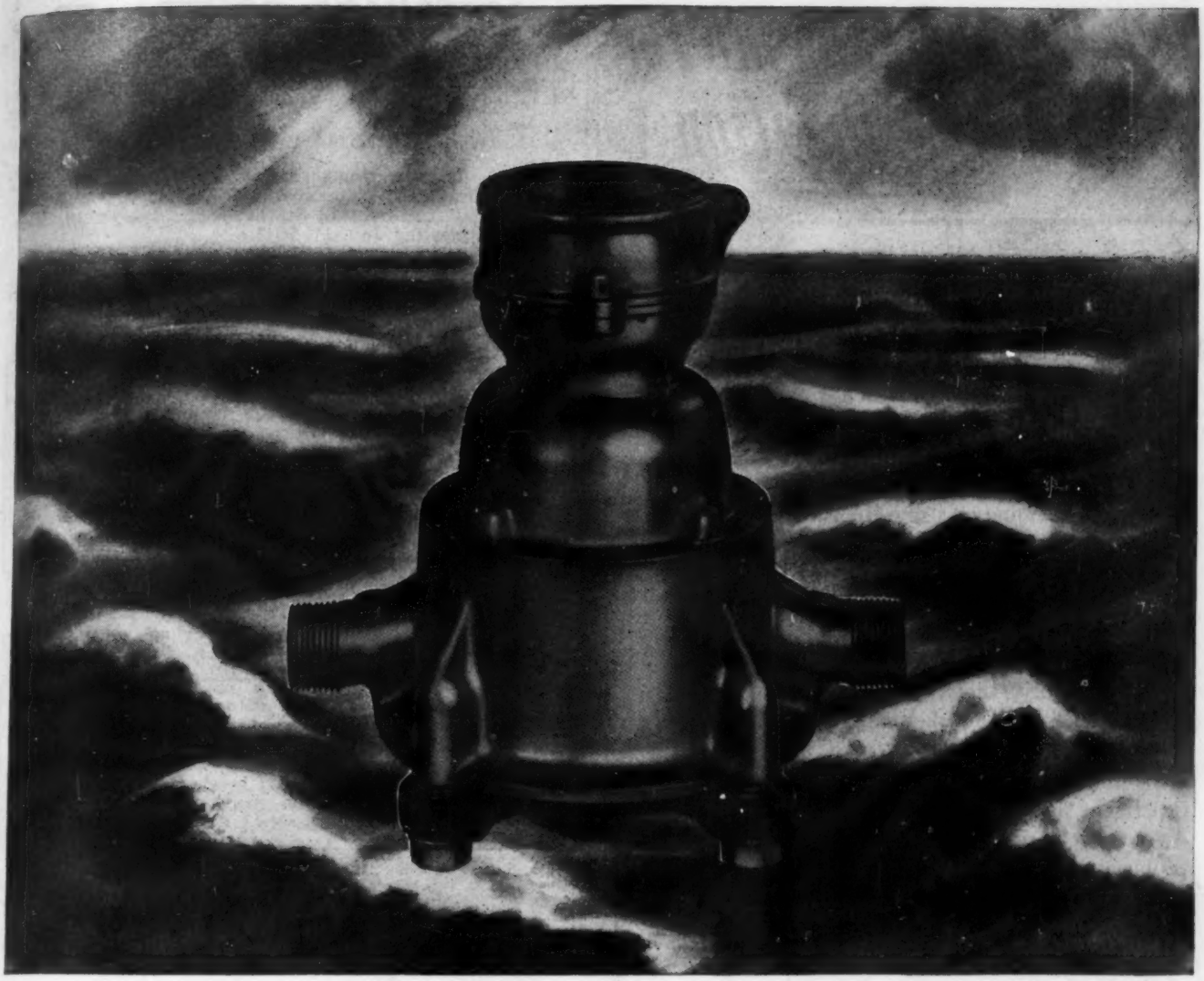
"Sincerely, your chair weary, smoke dazed conferee,

THOMAS POWERS,

Michigan Sewage Works Association."

To Tom Powers, and the many other Powers' whose feelings haven't gotten into print, we say—Amen, Brothers!

L. H. Enslow



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Sound engineering, durable construction, lasting dependability, designed and built into Badger water meters for 39 years, are proving their value today. These qualities are reflected in longer life, sustained accuracy, less need for repair and replacement and lower maintenance cost.

For 39 years Badger has stood for the finest materials, craftsmanship and presicion manufacture. Communities that invested in Badgers have proved the wisdom of their selection by the trouble-free service their Badger water meters have given. The Badger organization is prepared to help you with conservation of water meters — now a patriotic duty. Whether your problem is one of maintenance, repair or replacement, feel free to call on us.

BADGER METER MFG. CO.
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BRANCH OFFICES: New York City • Waco, Texas • Tampa, Fla. • Chicago, Ill. • Kansas City, Mo. • Savannah, Ga. • Marshalltown, Iowa • Seattle, Wash. • Los Angeles, Calif. • Philadelphia, Pa.

Representing recognition by the Army and Navy of especially meritorious production of war materials.

Use Hooker Chlorine for Effluent Sterilization

CHLORINATION of effluent is rapidly becoming standard practice in many sewage treatment plants. Not only does the chlorination of the effluent reduce the bacteria count, but tests indicate that by chlorinating sufficiently to maintain a residual of from 0.5 to 1.5 ppm a pronounced improvement was effected in the quality of the body of water into which the effluent was discharged.*

If you are planning on using chlorine in your sewage treatment, you can insure consistently uniform results by specifying Hooker Chlorine.

Because users know that they can depend on Hooker for uniform high quality, Hooker Liquid Chlorine is being specified by many sewage treatment plants and is the favorite there, as it has been among water works officials since Hooker first produced Chlorine over forty years ago.

Hooker's Technical Staff, with a background of experience that started with early commercial production of chlorine is at your service in solving your problems involving chlorine, and the other Hooker Chemicals.

"Hooker Liquid Chlorine" is a booklet which contains helpful information on this chemical and includes sections on materials for equipment, precautions, physical and chemical data and useful tables. Every water works and sewage official should have a copy. Available free when requested on your letterhead.

*"Results of Effluent Chlorination at Cleveland." Water Works and Sewerage, Aug., 1944, page 300.

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HOOKER CHEMICALS

Chlorine
Caustic Soda
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Ferric Chloride

MEETINGS SCHEDULED:

Dec. 13—AUGUSTA, ME.
Maine Water Utilities. (Bi-Monthly Meeting). Secretary, Earl A. Tarr, Supt., Water District, Winthrop, Me.
(Next meeting Feb. 14, 1945, Portland, Me.)

Dec. 21—BOSTON, MASS. (Statler Hotel).
New England Water Works Association. Secretary, Frank J. Gifford, 613 Statler Bldg., Boston 16, Mass. (Next meeting Jan. 11, 1945.)

Jan. 17-1945—NEW YORK, N. Y. (Pennsylvania Hotel)
New York Section A.W.W.A. Mid-Winter Luncheon Meeting. Secretary, R. K. Blanchard, 50 West 50th Street, New York, N. Y.

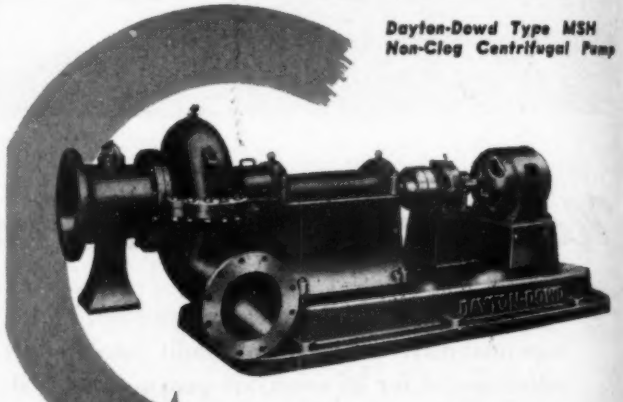
Jan. 17-19—NEW YORK, N. Y. (Commodore Hotel).
American Society of Civil Engineers. (Annual meeting.) Secretary, George T. Seabury, 33 West 39th St., New York, N. Y. (All technical sessions and social events to be held at Commodore Hotel.)

Jan. 19—NEW YORK, N. Y. (Hotel Pennsylvania).
New York State Sewage Works Association. (Annual Meeting.) Sec'y-Treas., A. S. Bedell, % State Dept. of Health, Albany, N. Y.

Feb. 5-7—COLLEGE STATION, TEXAS (Texas A. & M. College).
Texas Water and Sewerage Short School. (Annual Short Course.) Secretary, V. M. Ehlers, Austin, Texas.

May 7-11—ST. LOUIS, MO. (Municipal Auditorium).
American Water Works Association. (Annual Conference Secretary, Harry E. Jordan, 500 Fifth Ave., New York 18, N. Y. [Reservations at Jefferson, Statler and ten other selected hotels made only through Housing Bureau, Hotel Association, 910 Syndicate Trust Bldg., St. Louis, Mo.]

Dayton-Dowd Type MSH Non-Clog Centrifugal Pump



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TYPES — Single stage, single suction — mixed flow design. Available in both horizontal and vertical styles.

SIZES — 5" to 14". Capable of passing solids from 3" to 6" diameter.

USES — For handling liquids or solids such as sewage, sludge, paper and pulp stock and other similar substances.

CONSTRUCTION FEATURES — Motor and gas engine driven through reduction gears. Split case design provides easy accessibility. Special design impellers prevent clogging.

FREE CATALOG — Write on your business letterhead for interesting FREE Catalog. Address:
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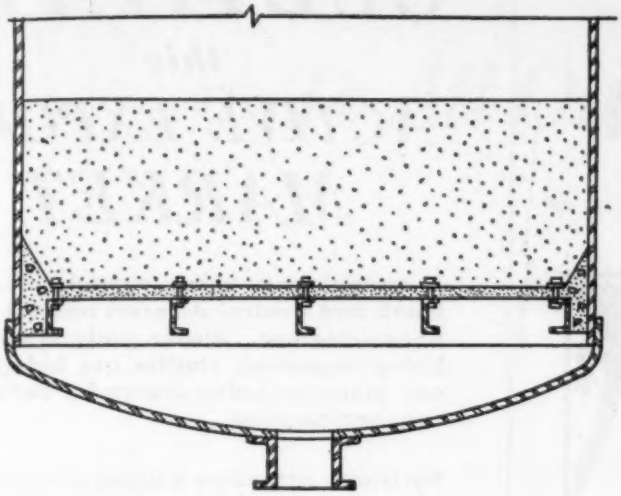
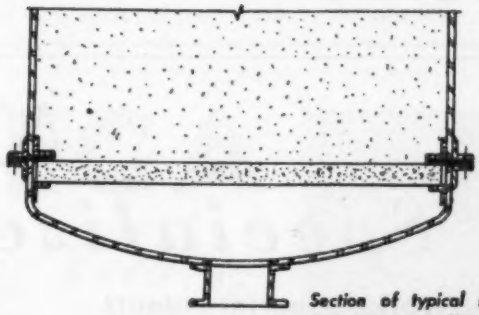
Turbine Pumps
Centrifugal Pumps



Section of typical large-diameter pressure filter utilizing standard and special plain underdrain plates.

FOR BOTH PRESSURE FILTERS AND WATER SOFTENERS

. . . The "ALOXITE" porous underdrain system has proved just as practical, efficient and economical as in large gravity units.



Section of typical small-diameter pressure filter utilizing a single plain circular underdrain plate.

In numerous installed units ranging from 1 to 9 feet in diameter, "ALOXITE" ceramically bonded aluminum oxide underdrain plates are giving the following outstanding benefits:

1. **No gravel** to become "upside down" through excessive or non-uniform wash.
2. **Reduced cost** of steel shell and some piping due to decreased height.
3. **Less washing** due to better uniformity.
4. **Reduced pressure** losses during both filtering and backwashing.

These and other benefits of the "ALOXITE" porous underdrain system are fully described in Engineering Bulletin No. 2. Write today for your copy.

THE CARBORUNDUM COMPANY
Refractories Division
Perth Amboy, New Jersey

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Porous Products by CARBORUNDUM TRADE MARK

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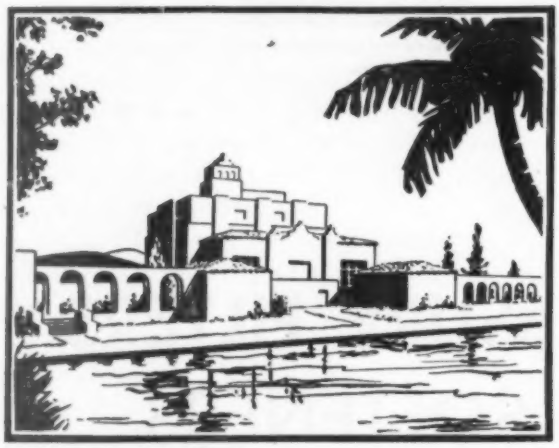
INGENIERIA SANITARIA



1945

CULTIVATE this ACTIVE EXPORT MARKET

A campaign is being waged throughout South and Central America against waterborne diseases. Water suply systems are being improved, studies are being made and plans are being drawn for better sanitary engineering.

Particular attention is being given to areas along strategic highways; around airports and shiping centers; and in the vicinity of defense bases. These activities are part of a campaign against typhoid fever and other diseases spread by waterborne parasites.

From Peru, from Colombia, from Mexico and Paraguay and all other Latin American countries come reports of plants under construction or plans in the making. Manufacturers of supplies and equipment to serve the water and sewerage fields, will find this export market worth cultivating.

NEW Specialized Coverage

Water Works Superintendents
Consulting Engineers
Managers of Utility Companies
Equipment Distributors

Manual de Ingenieria Sanitaria is designed to serve as a practical Reference and Data book for the men in Latin America charged with the problems of water supply and sanitation.

Printed in Spanish, it is a handbook of informative data and a buyers' guide. Published annually it gives to the advertisers year-around reader interest and offers access to the greatest potential market in the world today.

Sanitary Engineers
Chemists
Public Officials
Civil Engineers and Contractors

The first annual edition will be released in January 1945. It will be comparable to the English edition of the Reference and Data issue of Water Works and Sewerage, which is used by superintendents, operators, engineers and public officials throughout the United States and many other countries.

The Managing Editor of Ingenieria Sanitaria spent the summer of 1944 in South America making studies and reports of this field.

2,000 Guaranteed Circulation.
Schedule Space Now — Write for Details.

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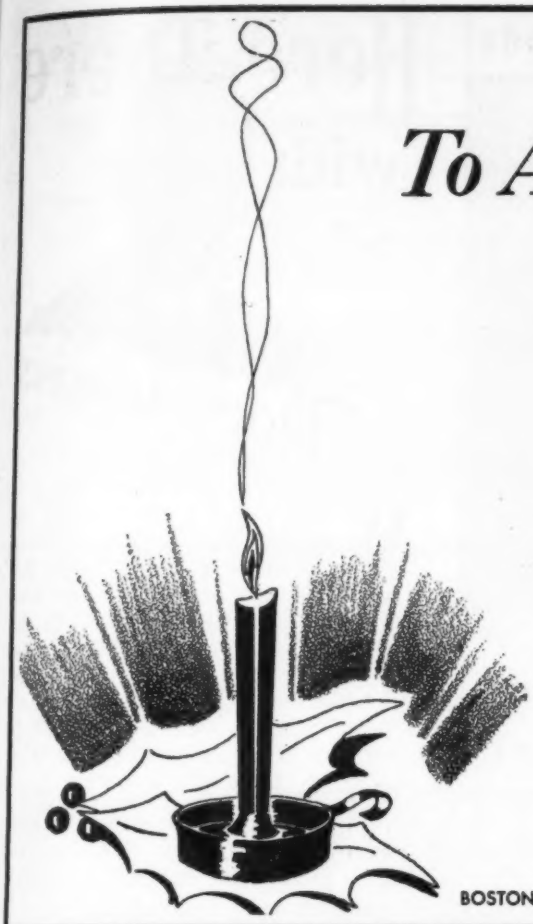
CLEVELAND NEW YORK LOS ANGELES



To All Our Friends

We extend cordial wishes for

A MERRY CHRISTMAS

and a

Prosperous New Year

with early Victory and Lasting Peace

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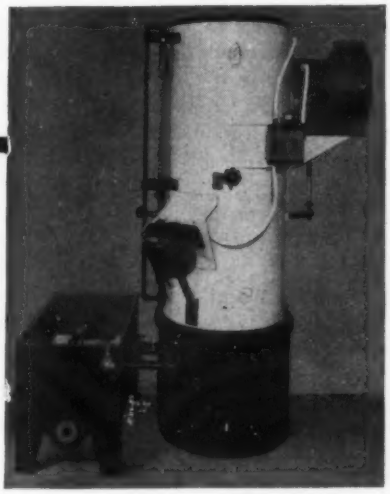

UNIVERSAL FEEDER

Three sizes cover a feeding range of 1 to 6,000 lbs. per hour. The high speed agitator in the dissolving chamber and Rotameter for measuring the water supply are used especially for dissolving Ferrisul, Ferrifloc and low grade Alum. The makeup tank illustrated introduces the dissolved chemical into a centrifugal pump or eductor without admitting air.

OMEGA

Automatic Feeding

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Cost Control

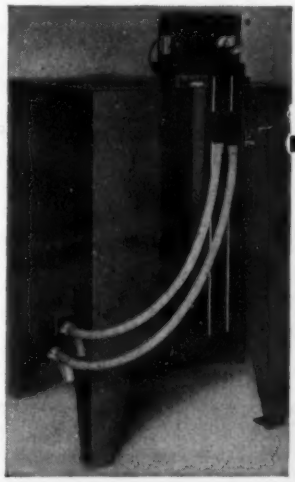
Omega Automatic Feeders are precision machines. Figure your production costs and know that feeding will be accurate, without wasteful or dangerous variations. For dependable, trouble-free feeding look to Omega. Write for information.

Sincerely,

OMEGA MACHINE CO.

Division of Builders Iron Foundry

9 Codding St., Providence 1, R. I.



PRECISION FEEDER

Feeds hypochlorite, Calgon, Ammonia, Ferric Chloride and acid solutions by gravity. Feeders are pre-set by a dial to the desired rate of feed. Accuracy is 99% plus. Wood, steel, lead lined or asphalt lined tanks are furnished. Where electricity is not available, operation is accomplished by an eight-day spring motor.

Water Needed for 6,000 New Homes!

One of the record-breaking Morris Pumps installed in the Wilmington Plant.

MORRIS PUMPS

Make a Record at Wilmington, N. C.

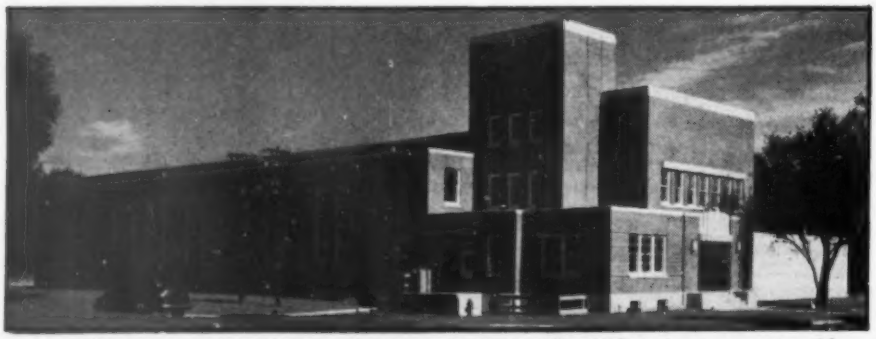
During the war boom the population of Wilmington, N. C., soared from 33,407 to over 100,000, and over 6,000 new housing units were constructed. The water supply became a problem even before the peak population was reached.

A new pumping plant was built and equipped with two Morris Pumps, one of 5-mgd capacity and one of 3-mgd capacity, pumping against a 200 ft. head. This installation, on December 16, 1943, during an unusually severe freeze, pumped over 6,200,000 gallons of water in 24 hours, to set a new pumpage record.

Proof again that when you install Morris Pumps you obtain:

1. Rugged construction with design stresses held low for smooth, reliable and trouble-free operation.
2. High efficiencies for maximum economy under continuous operation.
3. Quietness of operation.
4. Trim, workmanlike appearance which harmonizes with up-to-date plant design.

If you contemplate changes or additions to your water plant, ask for information now about Morris Pumps to fit your particular needs. More than three-quarters of a century of pump building experience stands behind every Morris Pump.



This new pumping plant is an important step in enabling Wilmington to compete with other southern cities for new industry

MORRIS MACHINE WORKS Baldwinsville, N. Y.

Branch Offices in Principal Cities

MORRIS CENTRIFUGAL PUMPS

Here and There with Doc Symons

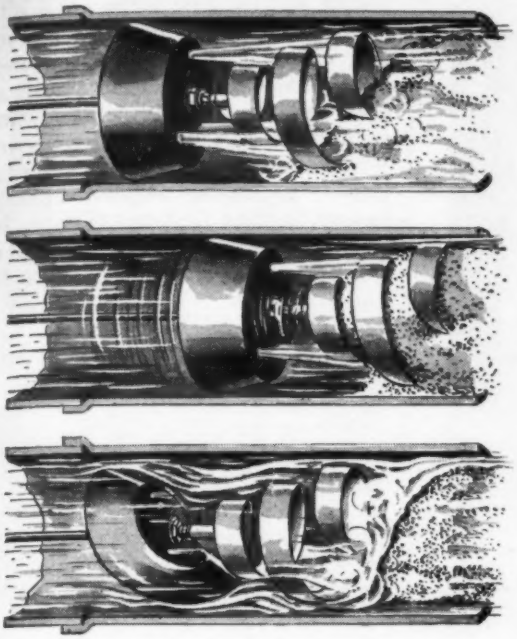
WHAT won't they think of next? Here we have been taking odors out of water for years, and now comes a man with the story that people are greatly affected by odors, some liking one, some another. Next thing we know we shall see the water companies asking "what flavor do you want in your drinking water or what odor in your bath water?"

A. Aumueller, of the Cramer-Krasselt Co. writing in the *Frontier*, says, "Odors and flavors exert profound influence on people, yet baffle all attempts of science to classify them. . . . Lacking a more exact method of classification, one must seek the key to odors' effect by trying them on many people. Classifying odors into six groups, flowery (rose, violet, heliotrope, etc.), spicy (cinnamon, clove, chocolate, etc.), burnt (coffee, maple, tobacco), resinous (camphor, cedar, pine, etc.), fruity (orange, lemon, apple), and putrid (rubber, onion, gasoline, etc.), Mr. Aumueller says that women generally show a higher preference for flowery, fruity, and spicy odors, and men have a slightly greater preference for resinous and burnt odors. Older persons like onion, garlic, jasmine, heliotrope, while young people like chocolate and gasoline. Unclassified were some of the odors found in water supplies which, fortunately for the activated carbon boys, nobody likes.

* * *

Overheard at Toronto; the speaker—Dr. A. E. Berry, President of the Sewage Wks. Federation: the spoken words—"That boy Wisely is fast developing into a wonderful association secretary."—And, coming from an expert and past master like "Bert" Berry, those are words of praise indeed.

"FLEXIBLES" + WATER PRESSURE



CLEAN SEWER PIPE!

ACTION NO. 1 WATER JETS WASH AWAY SAND
The head pressure of water in the manhole causes the water to jet through the holes in the Rubber Cup. This water levels off ahead and washes away loose sand during the whole cleaning operation.

ACTION NO. 2 LIKE A CORKSCREW, IT BORES IN
Powered by Flexible Rods, the auger bores in, loosening the sand or cutting roots while the water continues to spurt through holes in cup. The line being cleaned must be partially free flowing because this method depends entirely upon the head pressure to force the loose materials down the line.

ACTION NO. 3 RELEASING WATER PRESSURE
A pull back collapses the cup and releases a greater volume of water when the water level in the manhole rises too fast. This also serves to wash the sand or obstructions faster. Write today for illustrated catalog showing the various types of Flexible equipment.

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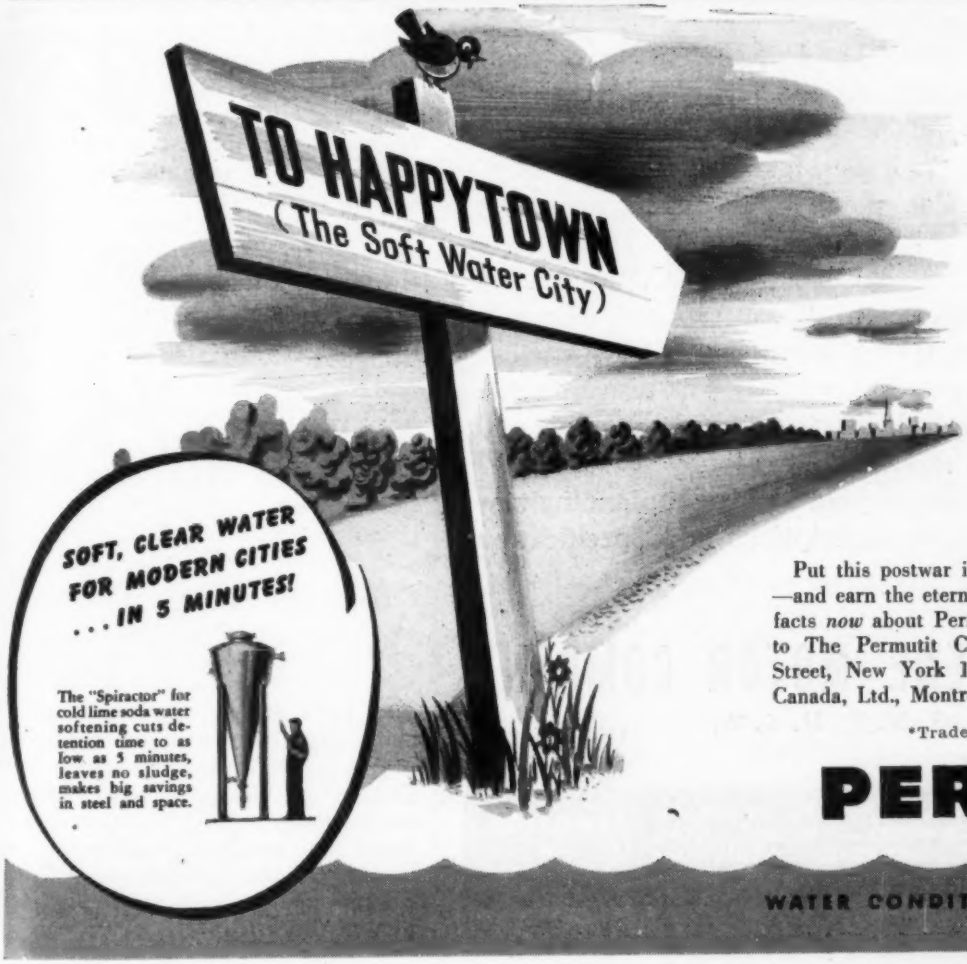

TO HAPPYTOWN
(The Soft Water City)
SOFT, CLEAR WATER FOR MODERN CITIES ...IN 5 MINUTES!
The "Spiractor" for cold lime soda water softening cuts detention time to as low as 5 minutes, leaves no sludge, makes big savings in steel and space.

EVER think how much happier and more prosperous your city would be with good water—free of hardness, dirt, iron and other impurities? Officials in hundreds of modern municipalities *have* thought about this—and have *done* something about it! They've installed Permutit* Water Conditioning equipment, and now enjoy soft, clear water from every faucet in town.

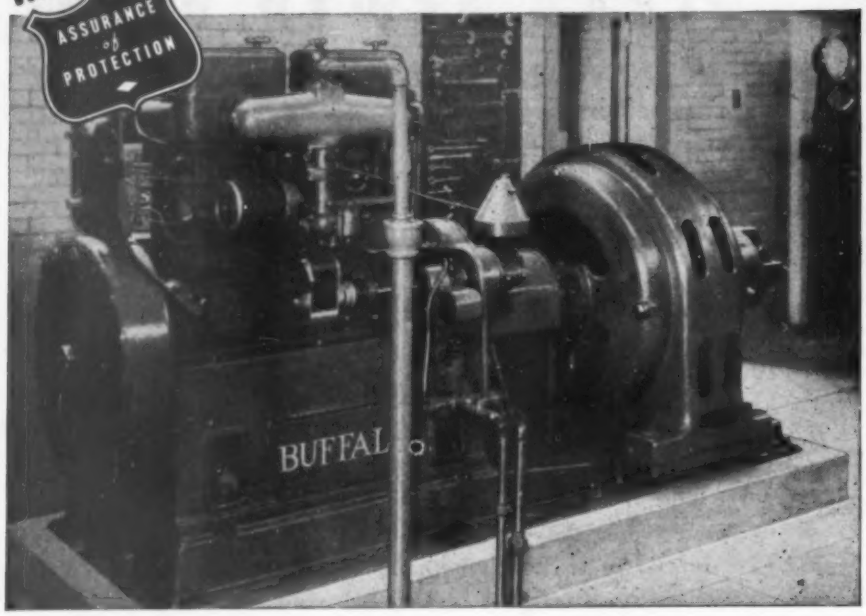
Put this postwar improvement at the head of your list—and earn the eternal gratitude of your citizens. Get the facts *now* about Permutit's economical equipment. Write to The Permutit Company, Dept. G1, 330 West 42nd Street, New York 18, N. Y., or Permutit Company of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

Main Pump Room—Sewage Treatment Plant, Norristown, Penna. A BUFFALO Model RA-4 Engine direct connected to an Ideal 75 Kva, 1200 RPM generator supplies emergency power.



WITHOUT STAND-BY EQUIPMENT

POWER FAILURE

...Breeds Disaster!

Rapidly as repairs to power lines and equipment can normally be made, there is always time for disaster to strike during a breakdown. Fire underwriters, who know more about this than anyone, base their rates upon it as a fact; hence in any community, stand-by equipment pays for itself in insurance savings.

For assurance of protection, select BUFFALO Engines for motor generator or pumping sets. Their specifications will convince the engineer that they are completely trustworthy, and a visit to a Buffalo-powered station will prove to the operating man that here is the ideally clean, quiet-running and dependable motor for this service.

Our years of experience are at your service in planning new installations. Write for motor descriptions and Specification Sheets for your files.

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BUFFALO ENGINES — 100 H. P. THROUGH 750 H. P.— IN GENERATOR AND PUMPING SETS FOR WATER WORKS — AIRPORTS — COMMUNICATIONS — FLOOD CONTROL — HOSPITALS — INSTITUTIONS — MINES — MOVABLE BRIDGES — THEATRES — SEWAGE PLANTS.

BUFFALO ENGINES
ASSURANCE of PROTECTION

If you visit the Columbus, O., water works you will see, not only one of the finest oldtime steam pumping plants, and the first large water softening plant in the country, but you will also see on the operating deck of the filters four brass spittoons that have been sitting in the same spots for over a quarter of a century. When asked why they were placed at those particular spots, Charlie Hoover replies that the distance between seemed to be just right when the operators were going down the line.

* * *

Do you remember that a month or two ago, I couldn't remember the name of that consulting engineer in Harrisburg, Pa.? Well, a kind friend sent in the chap's initials as I.M.G., but that *could* mean one million gallons. Who is pulling whose leg?

* * *

Charlie Murray of the Chicago Office of W.W.&S. spotted this "Correction Please" as evidence that others have trouble with "typographical errors." The "correction" mailed to readers stated that "on pages 6 and 10 of the July-Aug. 1944 issue of the Johnson National Drillers Journal the heading **Ground Water —Its Development, Uses, and Conservation** is incorrect. This heading in both cases should be **Protection of Ground Waterground Water Supplies. Supplies** with the subtitle **The Problem of Under-.**" Charlie Murray says this reminds him of the editor who in hailing the town hero intended to say "A battle scarred veteran" but when it appeared in type it said "A battle scared veteran." Next night an apologetic correction appeared which read "A bottle scarred veteran."

* * *

One of the favorite (?) pastimes of this columnist is abstracting the weekly Patent Gazette. Most of the fun comes from seeing what new idea one's friends have had, and I smile slightly when I see the name of Wes Gavett, Harry Schlenz, Cliff Cox, Don Walker, Tony Fischer, among many others. But there's one name that has been popping up frequently in the last year and it intrigues me. I don't know Mr. Augustus C. Durdin III.

For Post-War PUBLIC WORKS
Install "PUMPS by Aurora"

The superb performance that won high favor for Aurora Pumps on many vital war services will add to the overall efficiency of post-war public works installations. Acquaint yourself with these fine pumps. They will justify your confidence.

Aurora Deep Well Turbines for all conditions—4" to 24"

Type AD Hor. Split Case, Two Stage Centrifugal

NSA Aurora Centrifugal Sump Pump

Type OD Hor. Split-Case Double Suction Single Stage Centrifugal

APCO TURBINE-TYPE PUMPS—the simplest of all pumps. Ideal for small capacity, high head duties. Silent, compact and lasting.

APCO Horizontal Condensation Return Unit

Type GMC Close-Coupled Centrifugal

Write for **CONDENSED CATALOG OR**

Type GGU Side Suction Single Stage Centrifugal

APCO Single Stage Turbine-Type

SEE OUR CATALOG IN SWEET'S

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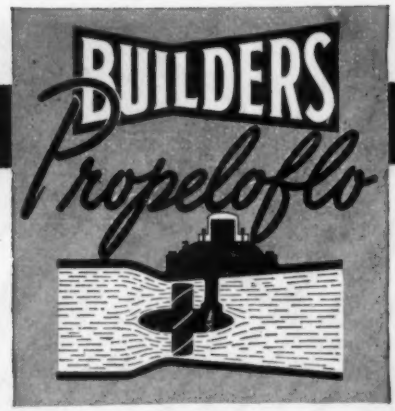
AURORA Always PUMPS

AURORA
PUMP COMPANY

68 Loucks Street, AURORA, ILLINOIS



CHECK THE ADVANTAGES OF THIS MAIN LINE FLOW METER

LOW COST: Complete in itself and easily installed.
ACCURATE: Within 2% over wide range of flow.
DIRECT READING: Counter totalizes flow directly in gallons.
VENTURI DESIGN: Results in increased accuracy and range.
BUILDERS QUALITY: Superior design and workmanship for over 50 years.

For Bulletin 350, attach to your letterhead and mail to Builders-Providence, Inc., (division of Builders Iron Foundry), 9 Codding St., Providence 1, R. I.

Sincerely Yours
BUILDERS-PROVIDENCE

Earle Gears assure positive operation, with long service life and little maintenance or replacement when incorporated in the vital parts of bar screens, skimmers, clarifiers, sluice gates, floor stands, etc. Time has tested them in hundreds of installations throughout the United States and abroad. Specify EARLE when drawing up your plans and writing your orders. Send today for booklet 42-G. The EARLE GEAR & MACHINE CO., 4725 Stenton Avenue, Philadelphia 44, Pa.

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SALES OFFICES:

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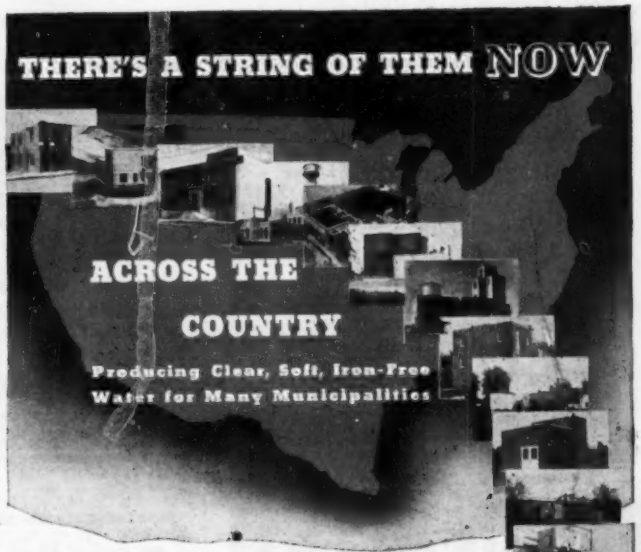

ACCELATORS are doing a lot of different things for a lot of different kinds of water . . . clarifying . . . softening . . . stabilizing . . . removing color . . . taking out iron.

Results are always excellent . . . frequently remarkable.

You can't beat ACCELATORS for Performance and Economy. Would you like Bulletin 1824?

INFILCO
INCORPORATED
325 W. 25th PLACE, CHICAGO 16, ILL.

HILL-HUBBELL Protection
Pipe is DURABLE

STEEL PIPE PROTECTION

STEEL PIPE PROTECTION is permanent only to the extent of exactness with which it is applied.

HILL-HUBBELL Factory Processed steel pipe, is cleaned, primed, coated and wrapped under RIGHT atmospheric and thermal conditions, by machines designed to produce maximum protection for long uninterrupted service.

Underground dollar value, in HILL-HUBBELL pipe protection, saves costly pipe line repair in point of years of pipe usefulness.

IT'S FACTORY PROCESSED

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. • Division • Cleveland, Ohio
• EXPORT OFFICE: SAN FRANCISCO, CALIFORNIA, U. S. A. •

ANTHRAFILT
A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
101 Park Ave. New York

H. G. Turner Research Engineer
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BAILEY METERS AND CONTROLLERS
FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY
1072 IVANHOE ROAD • CLEVELAND, O.
© Bailey Meter Co. Ltd., Montreal, Canada

Is my face red? There are a great many readers of this column who would have laughed with glee if they had heard me presenting a paper recently, for I ran over my thirty minute time allotment by four minutes—and, after all the fuss I've raised about programmers taking more than their share of time. The fact that one of the preceding speakers took 17 minutes when allotted five was no excuse for my offense, but the experience did make me feel more sympathetic toward program chairmen and discussion leaders—I actually feel sorry for them and some of the criticism they have to take.

* * *

Is it true, or is it false?—That Bill Johnson of Phoenix Meter has gone with Pittsburgh Equitable and that Phoenix Meter itself has gone to Neptune?—And, has Fred Nelson of Dorr Co. left the midwest and returned to his native California, the land that is dripping—with sunshine—And was Milt Spiegel of Chicago Pump on the trail of a Canadian collaborator (or has that word lost favor in the last few years) up at Toronto.

* * *

When I joined W.W.&S. as Assoc. Ed. I expected that there would be times when duty would require that I fill in for the editor, but *this* I never expected—At the Toronto Meeting of the CISS, the wives of some of Dr. Berry's staff members descended on me in force with the query—"Are you going to take that Virginia boy's place and dance with all of us?" I've learned to paste up pictures, edit articles, write editorials in the past year or so, and now it looks as though Arthur Murray is going to have a new pupil.

* * *

A news release recently from the battle headquarters in Europe indicates a new method of designation for W & T chlorinators. Not content with numbers for the machine the soldier operators of the first water points in Normandy gave the machines the names of Sally, Marion, Kathryn and Sue, after their respective wives. I haven't heard yet that Bill Orchard and Hal Hutton have decided to adopt the system in place of serial numbers.

* * *

Speaking of word mangling as we were once before, we think this one deserves some sort of "Oscar." A man who had patented a process for the treatment of sewage was explaining his patented process to the city

fathers in a small mid-western town, when some one asked if he didn't use chlorine in the process. Drawing himself up to his full height, he replied, "Certainly not, in my process the chemicals remove all of these poisonous bacteria, but when you add chlorine the dead bodies of the bacteria are left there to *petrify*."

* * *

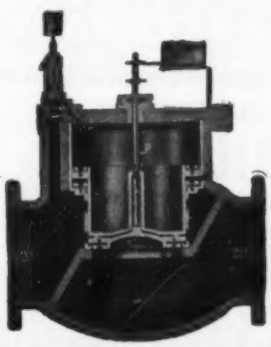
As I write this particular column on a train bound westward in the middle of the night, I can't help but think ahead and back.—Soon Christmas will be here, the season of Peace on Earth to Men of Good Will —How I wish I could say season's greetings to you all, and know that in your home all would be merry, that no cloud of war is dimming your fireside. I can and do say "Season's Greetings" but I know and you know that the third anniversary of Pearl Harbor will have but marked the beginning of our most intense efforts to eradicate an evil force from this earth. And, as this Christmastide approaches I think most of us civilians know how we, too, can help.

Electric Double Cushioned Check Valve

This valve is for use in connection with remote tank storage service with valve located adjacent to motor centrifugal pump, also where a high-low pressure or float-operated switch located at tank is wired to the valve in order to accomplish complete automatic sequence of operation for starting and stopping the pump with respect to storage water levels.

Sizes 3" to 36", angle and globe patterns.

Write for specifications.



GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

FOR THE SMALL SEWAGE PLANT THE ROYER "JR" IS IDEAL

This Royer "Jr." Sludge Disintegrator is converting sludge into fertilizer at Lincolnton, North Carolina—population 4,525.

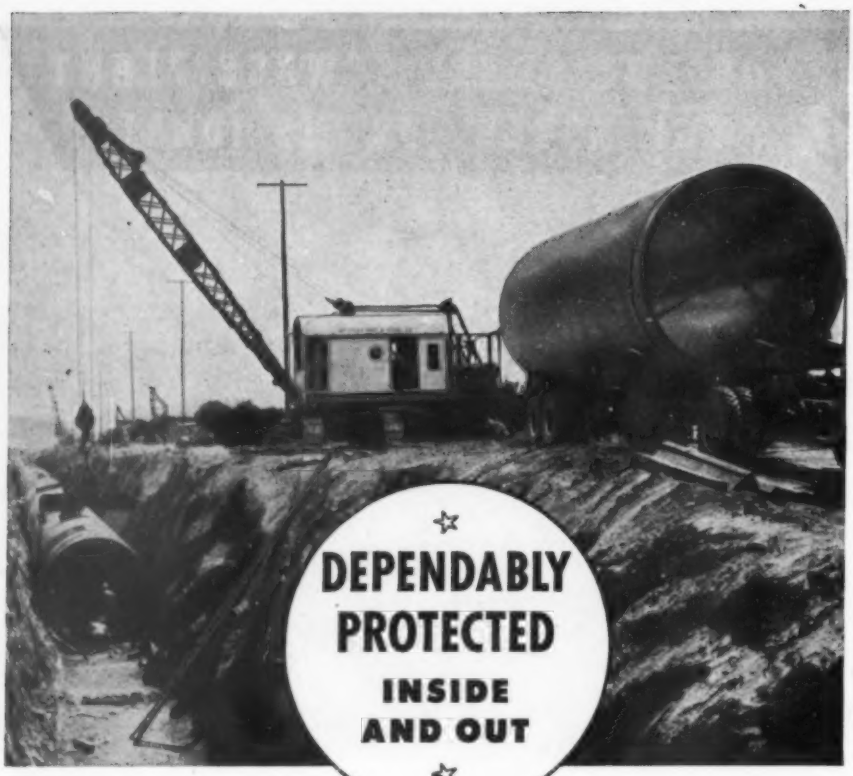
Although the amount of sludge from this sewage disposal plant is but 20 to 25 tons per year, the officials are reported as well pleased with their Royer; especially for the ease with which it can be moved anywhere on the drying basin. Fertilizer produced by this Royer is used on the city cemetery and school lawns. Farmers and gardeners take the surplus.

In cities of every size throughout the nation, Royers are making marketable fertilizer out of sludge at a cost no greater than that of burial or incineration. All the labor required is shoveling the sludge cake into the hopper. The machine shreds, mixes, aerates and further dries the material; discharging onto pile or truck an effective, ready-to-use fertilizer, which finds a ready market among Victory gardeners and commercial growers.

The Royer "Jr." has proved ideal for the smaller communities. In the larger cities other Royer models of greater capacities are producing substantial revenues for sewage disposal platns.

Write for the Sewage Sludge Utilization Catalog.

THE ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.
PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE



with *Reilly* ENAMEL

● Steel water conduits are subject to constant attacks from without and within. On the outside from corrosive agencies—moisture, electrolysis, soil acids and alkalies; on the inside from corrosion—also from incrustations and tuberculation.

REILLY Enamel protects both the outside and inside surfaces of steel water lines from all of these destructive forces. The results are longer life, lower maintenance costs, fewer service interruptions, and full-capacity flow for the life of the pipe.

Booklet describing REILLY Protective Coatings for all types of industrial applications will be sent on request.

Reilly COAL TAR PRODUCTS

17 PLANTS to Serve the Nation

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Reilly Protective Coatings

MANUFACTURERS' *and* EQUIPMENT News

Charlie Becker Passes

Charles H. Becker, Manager of the Hydrant and Valve Department of the R. D. Wood Co., Philadelphia, Pa., died November 9th, after an illness which confined him to the hospital for the past month.

Charlie, as he was so well known to his many friends, would have been fifty-one years old November 23rd. He had been associated with R. D. Wood Co. for 31 years, the past 17 years as Manager of the Hydrant and Valve Department.

C. H. Becker

In addition to his position with R. D. Wood Co. he was a director of the Florence Pipe Foundry and Machine Co., a member and director of the American Water Works Association, and President of the Water and Sewage Works Mfgrs. Assn., in

TAPAX

The ORIGINAL *and* FINEST....

Manhole Cushion U. S. Pat. No. 2,050,050 offers you the simplest solution for noisy, rattling covers. Easy to install. Lasting — Economical.

Write for story of Tapax and Trial Offer.

TAPAX MFG. CO., INC.
MAMARONECK NEW YORK

WATER WORKS VALVES and HYDRANTS
SINCE 1866

THE LUDLOW VALVE MFG. CO. INC.

TROY, N. Y. NEW YORK
CHICAGO BOSTON
PHILADELPHIA PITTSBURGH
KANSAS CITY, MO. HOUSTON

..for ACCURACY and TROUBLE-FREE OPERATION

INSIST ON THE WILSON HYPO-CHLORINATOR

Engineered and Manufactured by

WILSON

CHEMICAL FEEDERS, INC.

203 CLINTON STREET BUFFALO 4, N. Y.

which he had been active for a number of years.

Mr. Becker was a member of the Overbrook Country Club, Downtown Club of Philadelphia, and the Railroad and Machinery Club of New York.

Surviving are his widow, Helen (nee Montieth); a son, Edwin; daughter, Anne; and his mother, Mrs. Louisa Becker.

Badger's Hollowell Elected

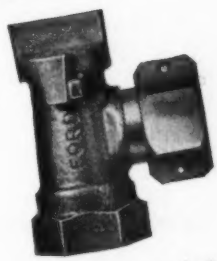
Pres. of Kansas Assoc. of Utilities Mfrs.

The Kansas Association of Municipal Utilities and the Kansas Association of Utilities Manufacturers and Suppliers, held their annual meeting jointly at Emporia, Kan., Oct. 8-10. A. Cooley Hollowell, Dist. Mgr. of the Kansas City Branch of the Badger Meter Mfg. Co., was elected President of the Kansas Association of Utilities Mfgrs. and Suppliers.

Dresser News

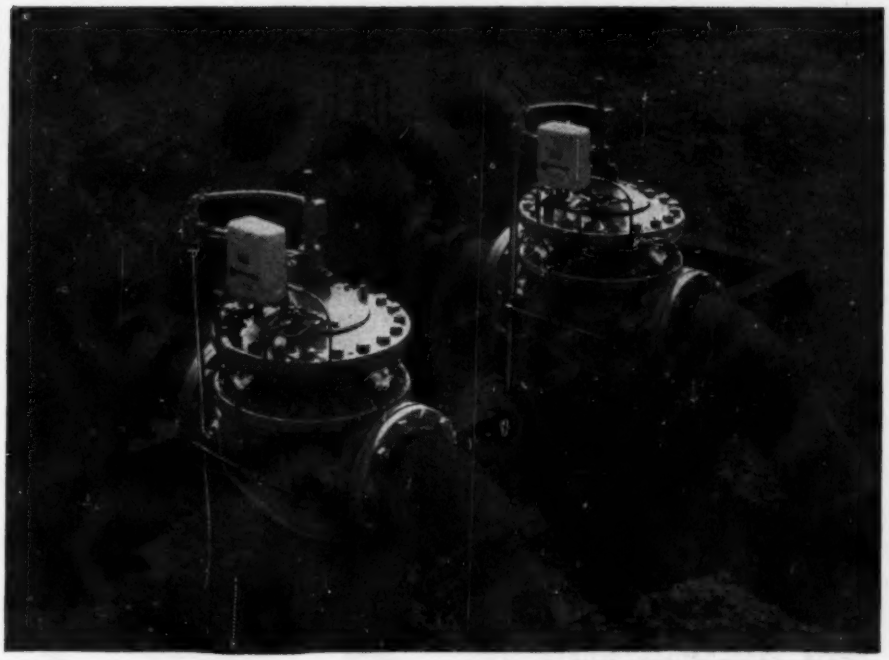
Since Nov. 1 when three new companies were added to Dresser Industries (International Derrick & Equipment, Roots-Connersville, and Stacey Bros.) and the name changed

Ringstyle VALVES



Quality inverted-key angle valves with coupling nuts for water meter attached. Made in three sizes. Connect to iron, copper or thin-wall lead. Simple. Easy to install. Ask for further information and free sample of RINGSTYLE Valve.

FORD
Meter Box Co.
WABASH, INDIANA



NO SURGE... NO SLAM...

NO SHOCK...

The Clayton Pump Control Valve provides complete . . . and automatic . . . protection for both the pipe line and pump when installed in connection with a Horizontal Centrifugal Booster Pump. Surge and shock are completely eliminated since the smooth operation of the valve in opening and closing prevents severe strains on the line and the pump. An unusual feature of the Clayton Pump Control Valve is its ability to close *automatically* in the event of power failure.

WRITE FOR ENGINEERING DATA
REPRESENTATIVES IN PRINCIPAL CITIES

VALVE DIVISION
CLAYTON
"Feather Touch" CONTROL

CLAYTON MANUFACTURING COMPANY, ALHAMBRA, CALIFORNIA

ADVANTAGES of Positive Displacement

Roots-Connersville Aerating Blowers, for water and sewage treatment, have the lowest power consumption per cubic foot of air delivered. Noted for exceptionally long life and ability to carry emergency loads in excess of rated capacities.

Twin impellers alternately suck in, momentarily entrap, and then expel definitely measured amounts of air, resulting in the delivery of four equal predetermined volumes each revolution of the drive shaft. Impellers need no seal or lubrication. Capacity varies with speed. Pressure automatically builds up to overcome resistance on discharge side.

Write for Bulletin 23-B-12 today, and be prepared to make the best selection.

ROOTS-CONNERSVILLE BLOWER CORP.
One of the Dresser Industries.
412 Mount Avenue Connersville, Ind.

Above photo shows "R-C" Blower used in water treatment process. Capacity 300 c.f.m., 640 r.p.m., 5 lbs. pressure.

Roots CONNERSVILLE SINCE 1854 Aerating BLOWERS

84" pipe—Spring Lake, N. J.

FLANGED PIPE
FLEXIBLE JOINT PIPE
BELL & SPIGOT PIPE
SPECIAL CASTINGS
SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 3" TO 84"

Warren Foundry & Pipe Corp.
11 Broadway, New York

Warren Pipe Company of Mass., Inc.

to Dresser Industries, Inc., the news has been full of changes in names and officers, and offices.

The Dresser Mfg. Co. itself becomes a division of Dresser Industries, Inc. Neil Mallon, formerly president of Dresser Mfg. Co., is now president of the parent company, the offices of which have been moved to Cleveland. Pres. Mallon has announced that Oscar M. Havekotte of Columbus, O., for the past four years president of the Internation-Stacey Corp. and of International Derrick and Equip. Co., has been elected a Director of Dresser Industries, Inc., and will remain as head of International Derrick and Equip. Co., while International-Stacey is dissolved.

Dickey Appt'd Chief Engr. of Bailey Meter

The Bailey Meter Co. of Cleveland, Ohio, has announced the appointment of P. S. Dickey as Chief Engineer to supervise all research and design activities for the company.

P. S. Dickey

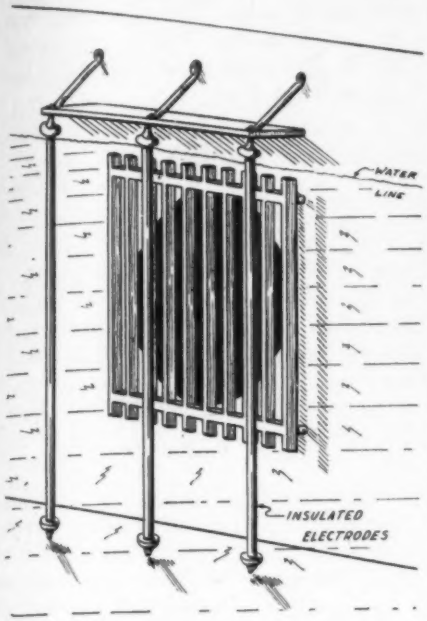
Mr. Dickey, who has been Research Engineer, will be assisted in his new duties by H. H. Gorrie, Asst. Ch. Engr., and R. E. Clank, Mgr. of Contract Engineering.

Burkey Electric Fish Screen

Are you troubled with fish swimming into your final tanks? We know a couple of fellows who are. Yes sir! the effluent was so attractive that the fish swam right up the outfall and hopped over the weirs into the tanks.

Well now we can tell them what to do about it. They can install Burkey Electric Fish Screens, a positive, harmless barrier to all fish. This electric Fish Screen consists of but three simple parts, the electronic impulse generator, live electrodes, suspended to swing freely from an overhead support but not touching the bottom of the stream (permitting

the passage of debris) and a suitable ground—or second electrode system—is provided to complete the circuit in the water thereby creating the



electrified zone of water or electric fish screen.

By means of the Burkey Electric Fish Screen, fish planted in lakes and streams can be saved from destruction through irrigation canals, mill races, intakes to power and pumping plants, and polluted areas. This new piece of equipment promises to be the modern and scientific method of fish conservation. This looks like the real thing, not a motion picture although it is produced in Hollywood, Calif., by the Electric Fish Screen Co. of 1130 N. Poinsettia Place.

Fleming Joins Hydraulic and Ben Crabbe Again Selling Hydro-tite

Fleming, of Chicago,* will handle sales and distribution of "Hydro-Tite" joint compound and the sanitary joint packing "Fibrex" in the states of Ind., Ill., Wis., and Mich.,

Fleming

[*If you ask Fleming what his first name is, he will reply—"Oh, just call me Fleming of Chicago."—Ed.]

CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

"GUNITE" DIVISION WALL IN RESERVOIR

The photograph shows a reinforced "GUNITE" division wall through the center of the Clear Springs Reservoir of the borough of Northampton, Penna., built to facilitate necessary periodical cleaning. Although the slab has a maximum thickness of 5", there is no leakage during cleaning periods. This wall was built by us in 1923 and in 1941, we lined the original concrete walls of this reservoir with "GUNITE."

Many reservoirs have been built and reconditioned with "GUNITE." Our Bulletin 2200 illustrates and describes outstanding examples as well as a multitude of other uses. Send for a copy.

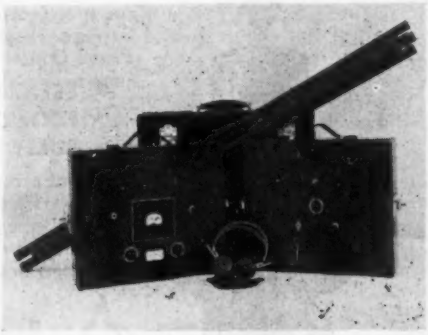
MANUFACTURERS OF THE "CEMENT GUN"

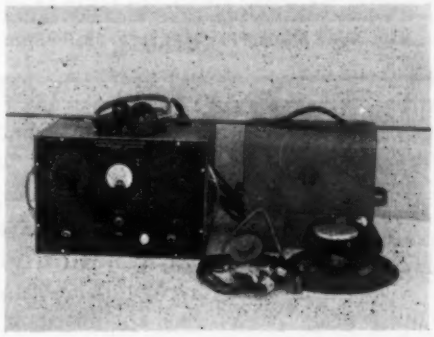
M-SCOPE

Pipe Finder

Leak Survey Equipment

Leak Detector





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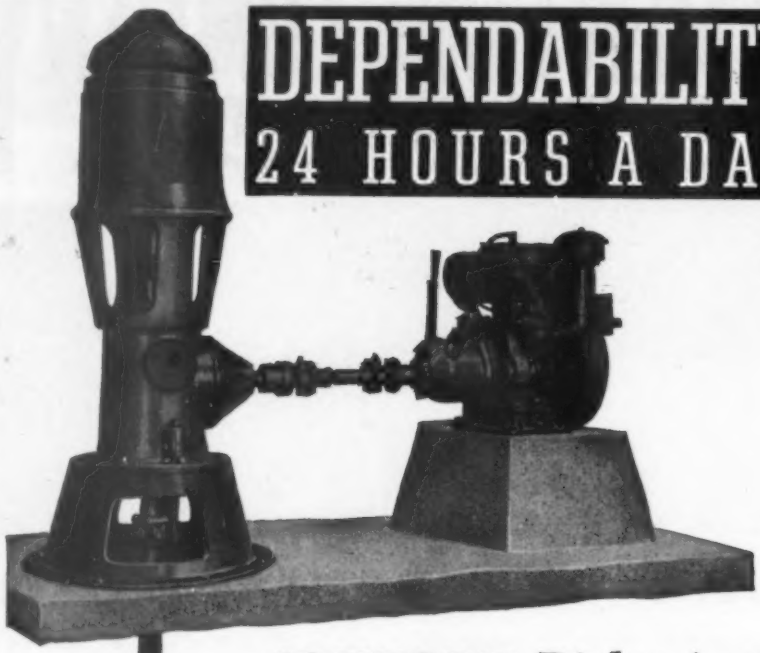


DEPENDABILITY
24 HOURS A DAY

JOHNSON *Right-Angle*
PUMP DRIVE

★ SEWAGE ★ WATER WORKS ★
FIRE FIGHTING ★ FLOOD CONTROL

The Johnson Right-Angle Gear Drive is used as a "connecting unit" between the pump and the power unit. Illustration shows a combination application. These drives are manufactured in a variety of types and sizes, each designed to meet the specifications of a wide range of applications—Sewage Disposal; Water Supply; Fire Fighting; Flood Control; etc.

★ EFFICIENT ★ DEPENDABLE
★ ECONOMICAL ★ COMPACT
★ FULLY ENCLOSED ★ LONG LIFE

The Johnson Right-Angle Gear Drive is sold through Pump and Engine Manufacturers—their local representative will explain the many advantages of this drive which is used by scores of municipalities. Write for Catalog No. 12.

JOHNSON GEAR
& MANUFACTURING CO., LTD.
MAIN OFFICE AND WORKS: BERKELEY, CALIFORNIA

according to an announcement by Hydraulic Development Corp., now maintaining a warehouse stock in Chicago. Fleming, with offices in the Engineering Bldg. at 205 W. Wacker Drive, is widely known in the municipal field in the Chicago area.

Ben F. Crabbe, of Birmingham, Ala., who recently severed his connection with Hydraulic Development Corp. to sell a competitive product, is now back with Hydraulic. He will sell "Hydro-Tite" and "Fibrex" in the states of Ala., Miss., Ga., Tenn., and Fla., this latter state being in addition to his former territory.

Allen Billmyre Has New Tenn. Representative

Allen Billmyre Co. of Mamaroneck, N. Y., has appointed Johnson & Scott of Memphis, Tenn., to handle all Tennessee sales of Billmyre Turbo Blowers and Exhausters, Pottstown Rotary Blowers and Exhausters, and other Allen Billmyre products.

McCargo Made Carborundum's Eastern Manager

With the elevation of F. Jerome Tone, Jr., to Vice-president in charge of sales, The Carborundum Co. of Niagara Falls, has named W. T. McCargo to be Eastern Regional Sales Mgr.

W. T. McCargo

Mr. McCargo returns to the company after a leave of absence during which he had served as consultant to the Secretary of War and later as Government Presiding Officer of Abrasive Industry Advisory Committee.

"E" Award to Hays Mfg.

One of the recent awards of the Army-Navy "E" was to the Hays Manufacturing Co. of Erie, Pa., makers of stops, fittings, etc. for the waterworks field. The occasion was doubly interesting because the Hays Mfg. Co. is celebrating its seventy-fifth anniversary.

Midget Ratchet Set

Darndest thing you ever saw—almost the smallest too. A vest pocket ratchet set. The complete set of specially treated alloy steel, hardened and tempered, consists of fourteen pieces in a specially designed kit looking like a case for eye glasses. With wrenches, Allen adaptors, and screw drivers from ⅛ in. to 9/32 in. and a small 0.050 Allen Wrench this kit will have a dozen uses around a shop, home, or car. Sets are available out of stock and may be obtained from Tapax Mfg. Co., Inc., Mamaroneck, N. Y.

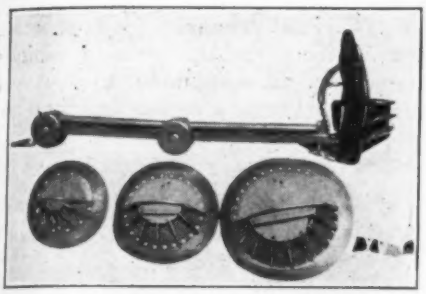
Oilite Self-Lubricating Bearing Bronze

For machine breakdowns or plant maintenance Oilite Self-Lubricating Bronze either cored or solid bars, plates and strips is available from the Beemer Engr. Co., Philadelphia. This new development is unique in

that Oilite is virtually a Phosphor Bronze in the form of a metallic sponge, having an oil absorption capacity of approximately ⅓ by volume. This oil comes to the surface as needed and the impregnated oil eliminates metal to metal contact and produces low co-efficients of friction. Catalogs and further information may be obtained from the Beemer Engineering Co., Philadelphia 8, Pa.

Sewer Scooter

Want a thirty-day trial of a machine to clean your sewers? If so write to J. C. Fitzgerald, Box 289, Coral Gables 34, Fla. Fitzgerald will send you the Sewer Scooter, "the only 100 per cent self-propelling sewer cleaning machine." Reducing cleaning time by 75 to 80 per cent, the Sewer Scooter combines the principles of the flushing tank, scraper, and hydraulic piston. It is



propelled by the head of water built up in a manhole, and this head of water furnishes the motive power to propel the cleaner through the line.

According to Mr. Fitzgerald after using the Sewer Scooter "it is not necessary to send any other piece of equipment through the line to 'sweep up the leavin's' as the line is completely cleaned." It's effective where grease and sand create a problem, and comes in all sizes from 8-in. to 15-in. in Model A-3, and 15 to 36-in. in Model B, or special Model C for sewers larger than 36-in.

IMPROVED JOINTING COMPOUND

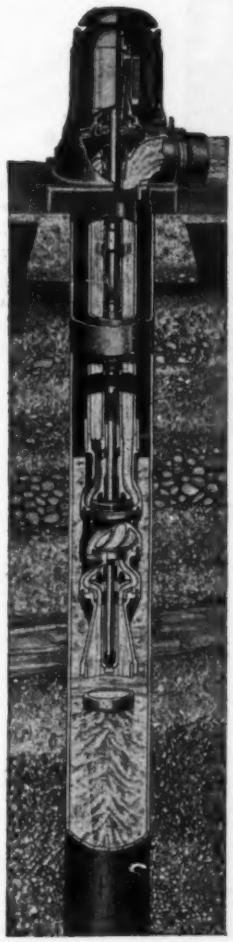
Tegul-MINERALEAD

for Bell & Spigot Main

- Sulphur base; quick sealing, speeding laying and backfilling.
- 10 lb. ingot form, easily handled, stored and shipped. Impervious to rain. Cannot change composition.
- Makes permanently tight joints. Goes 3 to 5 times as far as lead, helping conserve a strategic war metal.
- For money-saving information, write

The ATLAS MINERAL Products Company of Pa.
Mertztown Pennsylvania

PUMPING WATER
"the economical way"



ARMY NAVY
PEERLESS PUMPS

With Peerless Turbine Pumps

The indisputable *economy of operation*, that is peculiarly a *Peerless feature*, is not just a happenstance. The ingenuity of top-notch engineers, the unusual skill of precision-minded, highly-trained pump building mechanics working with *better materials*, plus years of painstaking laboratory and field tests alone were the factors responsible for not only the marked economy, higher sustained efficiency and greater dependability of every Peerless pump, but also the fact that Peerless products are from the factories of the world's largest manufacturer of deep well Turbine pumps.

Experienced Pump Engineers to assist you

The Peerless Pump Distribution Organization, a member of which will be found in your near neighborhood, is composed of the most efficient and dependable pump men in the country today. Cooperating with our own factory-trained field engineers, they stand ready to offer you of their wide experience and skill.

PEERLESS PUMPS

PEERLESS PUMP DIVISION
Food Machinery Corporation

TURBINE
HI-LIFT
HYDRO-FOIL

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GRAVER

WATER CONDITIONING EQUIPMENT

•

TO MEET EVERY REQUIREMENT

GRAVER TANK & MFG. CO., INC.

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New York Catasauqua, Pa. Chicago Tulsa

GAS • WATER • OIL
METERS
GAS PRESSURE
REGULATORS
NORDSTROM LUBRICATED PLUG
VALVES

Pittsburgh Equitable Meter Co.
Merco Nordstrom Valve Co.
Main Office and Works—PITTSBURGH, PA.

Portsmouth, Va., with a heavy influx of Navy Yard workers, increased its water supply from 6,000,000 to 13,000,000 gallons per day by building a 13-mile water line of 30-in. concrete pipe. Laying crew placed 400 ft. of pipe daily.

Water and sewerage projects need the durability and economy of

CONCRETE PIPE

Concrete pipe has proved its durability on a vast scale, with installations dating back half a century and more. It fully meets ALL the requirements of moderate first cost, structural safety, minimum infiltration and leakage, and maximum hydraulic capacity.

Technical information about concrete pipe or other concrete construction is available to engineers and builders engaged in sewerage, drainage or water supply projects.

PORTLAND CEMENT ASSOCIATION

Dept. 12-29, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

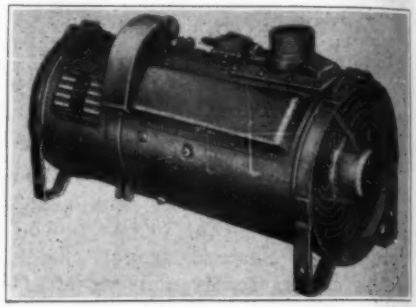
★ ★ ★ BUY MORE WAR BONDS ★ ★ ★

Aluminum Ladder

Do you ever do work overhead? Do you get tired of lugging a heavy ladder around? Would you like a safer ladder? If so, take a look at the accompanying photograph which shows a new type "F" all metal (duralumin) industrial ladder in the famous channel construction of the Duo-Safety Ladder Corp. These ladders may be equipped with top and bottom insulating boots, and of course have web steel brackets and open-type positive action locks. According to the Duo-Safety Ladder Co. of Oshkosh, Wis., Type "F" ladder is the "Hit of the Year."

Enclosed Combustion Heater

Designed primarily for application to heating requirements in vehicles and ground equipment, a new type gasoline burning heater has been announced by the Herman Nelson Corp., Moline, Ill. Known as Model AT-1000 Vehicle Heater, this new piece of equipment has a heat output of 20,000 Btu., but the unit is only 15 inches in length, with an



SAVE *with* TENNESSEE CORPORATION Ferri-Floc

Write today for actual case histories of plants now using the ideal ferric coagulant.

TENNESSEE CORPORATION

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THE *Phipps & Bird* LABORATORY MIXER . . .

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.

SAVE MONEY USE ACTIVATED ALUM and BLACKALUM

STUART-BRUMLEY CORP.

516 North Charles St.

Baltimore Maryland

outer shell diameter of 6⅛ inches and weighs but 17 pounds. Installation requires only a supply of fuel and a source of electricity. Models are available for 6, 12, and 24 volts d.c. Suggested applications of the heater include automobiles, trucks, temporary shelters, and on construction work. It will be available after the war from the Herman Nelson Corp. of Moline, Ill.

New Flow Splitting Device

A new flow splitter, called the Micro-Rotaweir, is available to accurately divide a liquid flow into two streams. The proportions of flow division may be varied at will by adjusting an outside lever and pointer to the percentage desired, as indicated on an external scale. The Micro-Rotaweir will handle flows from 30 gph. to 900 gph. and sizes up to 15,000 gph. are contemplated by the Fischer & Porter Co., 954 County Line Road, Hatboro, Pa.

Le Roi Makes Sedgwick Sales Manager

The Le Roi Co. of Milwaukee has announced the advancement of Norman M. Sedgwick from the position of Asst. Mgr. to that of Sales Manager of the Compressor Division of the Company. With sixteen years of service in the company behind him Mr. Sedgwick brings a knowledge of shop, field service, purchasing, and sales to his new responsibility.

N. M. Sedgwick

Cutler-Hammer in South Bend

The home of the far famed football team of Notre Dame has lately seen another famous name on North Main Street. Cutler-Hammer of Milwaukee, Wis., has announced the opening of a sales office in South Bend, Ind. Mr. Terry Fisher will be in charge.

SMITH INSERTING VALVES

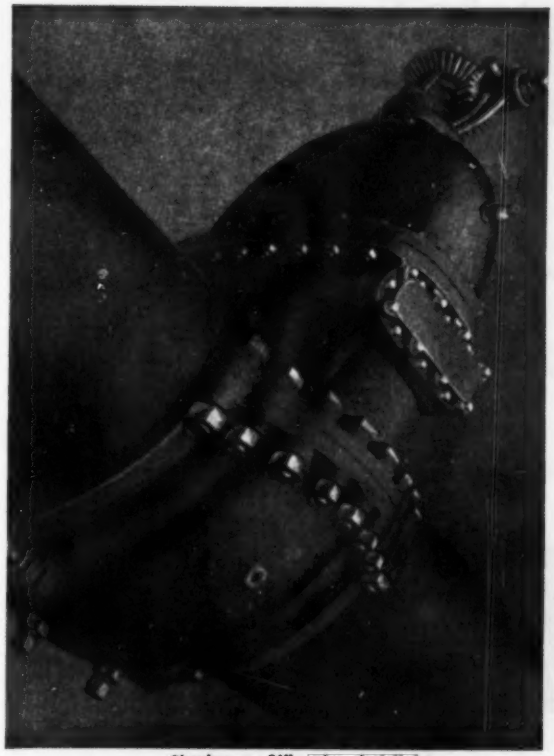
THE A.P. SMITH MFG. CO. EAST ORANGE, N.J.

Symbol of Quality Since 1889

NO SHUT-DOWNS NECESSARY!

Water shut-offs mean Industrial shut-downs, and this in turn impedes the war effort. These shut-offs are not necessary when a valve insertion is made.

With a Smith Valve Inserting Machine you can insert valves with the service at full pressure. These machines are made in 6 sizes for inserting 4" to 36" valves, are simple and easy to operate and do a surprisingly quick, clean job.



Showing a 24" valve installed horizontally under pressure.

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Valves and Hydrants — Valve Inserting Machines — Tapping Sleeves — Tapping Valves — Hat Flanges and Water Meters

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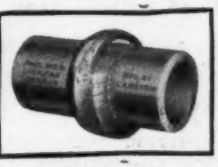
THE A. P. SMITH MFG. CO., EAST ORANGE, N. J.

WESTON



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The Perfected Method for Making
The PIPE JOINTS OF CEMENT

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON Adams, Mass.

BLEACHING POWDER
FOR WATER SANITATION

COPPERAS
SULPHATE OF IRON
FOR WATER PURIFICATION

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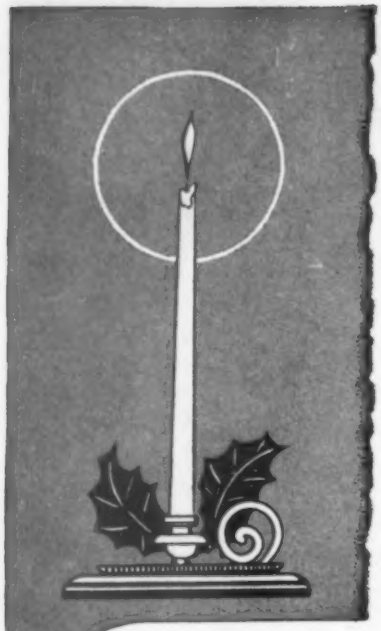

1869 HAYS 1945

WE are fighting that the Spirit of Christmas may rule the world, and that each Happy New Year may be happier than the last. As we enter the 76th year of our business existence, we feel younger, stronger, and more confident of our own and our country's future prosperity than ever before.

Our seventy-five years of progress have been possible because our own efforts have been backed by the loyalty of our customers and the cooperation of our employees. Without that loyalty and cooperation we could never have accomplished our record of 1944, we could never have won the coveted Army-Navy "E"

So let's join in a toast to the inseparable future success of all three of us; and to the continued Free Enterprise and Free Opportunity which make our success possible.

HAYS

COPPER · BRASS · LEAD · IRON

WATER WORKS PRODUCTS

HAYS MANUFACTURING CO., ERIE, PA.

The TATE Cement Lining Process Restores efficiency of old Water Maines

Now is the time to investigate the Tate Cement Lining process —and see what it can do to restore the efficiency of your old water mains.

View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

Write for Literature.

What the TATE Process accomplishes

1. Water mains cleaned and cement-lined without removing pipe.
2. Eliminates discoloration and further cleaning costs.
3. Reduces pumping costs.
4. Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.
5. All joints cement-lined . . . just one continuous pipe.
6. Does the job without interruption of service to consumer.

TATE PIPE LININGS, Inc.

ANDOVER, MASS.

Schmitz, A-C Pacific Mgr.

Allis Chalmers Mfg. Co. has announced the appointment of A. J. Schmitz as Pacific Regional Mgr. A graduate mechanical and electrical engineer, Mr. Schmitz has been with the company since 1914 and has until recently been manager of the Seattle office.

LITERATURE AND CATALOGS

Offhand we wouldn't say that these two bulletins go hand in hand, but Infilco has recently released **No. 1960, Ion Exchangers** and **No. 2436, Sewage Samplers.** According to the former, it is possible by use of controlled exchange catexers and anexers or other -exers using verdite, crystalite, fluorex or borex or sodium or hydrogen exchangers, to take a hard water and make a completely soft one having no more solids or ions therein than you want. Now the sewage sampler is another story. It doesn't employ several pieces of equipment. Just one refrigeration unit, containing the sample bottle and connected with a copper funnel and ladle run by a small motor. The whole device may be set to proportion the sampling to the sewage flow, something that is very important. Any piece of equipment that mathematically proportions the samples to all flows deserves enough attention in its placement to make sure that the sample take off is representative of the average concentration of the sewage.

As we said, we don't believe these two bulletins 1960 or 2430 are mated in any way but if you're interested in either, write Infilco, Inc., 325 W. 25th Place, Chicago 16, Ill.

"Safe Sanitation for a Nation" is the caption of a well timed and effective brochure from Pacific Flush Tank Co. which is aimed at postwar construction of new sewage treatment plants and modernization or enlargement of existing plants. Looking forward to what is anticipated as being a history making sanitation era following on the heels of the world's greatest and most costly of wars won.

In this well-planned booklet P.F.T,. who classifies as the only company engaged solely in the manufacture of sewage treatment equipment exclusively since 1893,

Keep Your Customers Smiling With GOOD Tasting Water

HYDRODARCO

You're sure to supply good tasting water when Hydrodarco handles the purification job. An activated carbon, Hydrodarco does it at reasonable cost. Test its performance in your plant—details on request.

Hydrodarco: Reg. U. S. Pat. Off.

DARCO CORPORATION

60 East 42nd Street, New York 17, N. Y.

Distributing Points: New York Buffalo Cincinnati Chicago St. Louis Kansas City San Francisco Los Angeles Marshall, Texas

presents pages of briefs covering the various items of equipment it has to offer plant operators and designers of the sewage plant of tomorrow. If you haven't seen this review of P.F.T. equipment request a copy from Pacific Flush Tank Co., 4241 Ravenswood, Ave., Chicago, Ill.

Not one booklet, but two are available from Filtros, Inc., on the subject of porous mineral media. The first, smaller and more recent of the two, deals with the use of **Filtros Plates for Aeration, Agitation, and Diffusion.** In not too many words, and a few well chosen pictures the reader can learn something of the size, shape, grades, and methods of rating the plates, as well as how to estimate requirements, install and cement the plates.

The older booklet contains more detailed information on Filtros and its many uses. Both booklets are available on request to Filtros, Inc., East Rochester, N. Y.

A picture in the recent edition of Chain Belt's **"The Rex World"** caught our eye. It shows a Rex Pumpcrete (concrete pump) in an

HYDRO-TITE

HYDRO-TITE — The self-caulking joint compound that makes cast iron water pipe joints — strong — tight — flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

FIBREX — The sanitary paper packing that is used like braided jute. Free from bacteria — treated with a water repellent — put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

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1879

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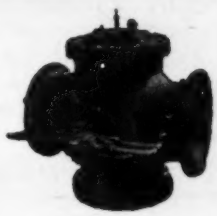
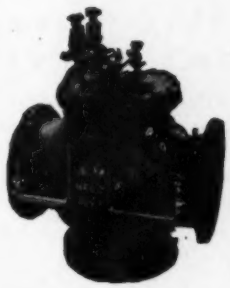
ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

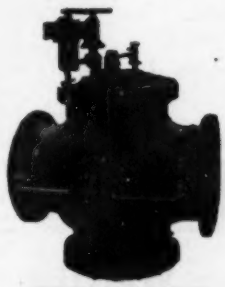
FLOAT VALVES • REDUCING AND REGULATING VALVES



ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.



COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.



REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

"Blueprint Now!"

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

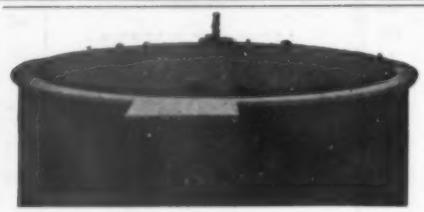
KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*



Over 225 P.F.T. Floating Covers in War Service

The health of our fighting men and war workers is being safeguarded by modern sewage disposal plants. We are doing our part by delivering on time P.F.T. Floating Covers and other sewage treatment equipment.

The P.F.T. Floating Cover for single and stage digestion hastens the digestion process, and provides for utilizing the sewage gas to heat water for the digester tank.

Catalog No. 232 contains complete information, including specifications. Write for your copy.

P.F.T. PACIFIC FLUSH-TANK CO. 4241 Ravenswood Ave., Chicago, Ill. New York Charlotte, N. C.

A mud valve may seems to be but a small item in your equipment, yet it is highly important that it function as perfectly as your most expensive gate valve. That is why you must insist upon the best—and that means MUELLER-COLUMBIAN Water and Sewage Control Equipment. For 84 years MUELLER has led the field. Write for Catalog A-300 and further details.

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Nationally-Known

MANUFACTURING A WELL-ROUNDED LINE OF SEWAGE TREATMENT AND PUMPING EQUIPMENT

An Opportunity To Participate In Post-War Sales To An Expanding Market

In reply indicate territory you cover and lines you represent. Write Box 900, Water Works and Sewerage, 330 S. Wells Street, Chicago 6, Ill.

Buy More War Bonds

unusual installation, with concrete being pumped by a reverse Y-pipe line and discharged onto a whirling pipe form to make pre-stressed, centrifugally cast shells. The Pumpcrete deposits just the right amount of concrete and thus holds waste to a minimum. What made it of interest to us? We remember that **W.W.&S.** ran an article last year by W. W. DeBerard of Chicago on the use of that kind of pipe for a water main, and in that article was a picture of two men shovelling the concrete into the whirling pipe—looks like Chain Belt Co. of Milwaukee has a better idea.

A few months ago we reproduced in these columns a cut of the Universal Calculator, designed by T. Francis O'Connor and issued by the Grinnell Co. of Providence, R. I. Now in our mail recently was a folder entitled **"Instructions for Using the Universal Calculator."** This pocket-size folder is punched for a Leafax Note Book and, strange as it may seem, it does tell how to use that multiple slide rule which shows simultaneously, all hydraulic factors usually required in water works problems involving flow of water in pipes. Three examples are given. (No price tag attached.)

We and the Blueprint Now Committee are not the only ones who are plugging the plan now for post war work. Two folders in a recent mail from the Armco Drainage Products Corporation of Middletown, Ohio, stress the same theme. One is beamed at highway readers but the other on **Suggestions and Useful Data for the Better Community You Are Planning,** has several items of interest to persons in the municipal field and particularly those interested in water works, sewerage or drainage.

Writing in the October issue of the *APHA Journal,* Irving Reichman, Inspector of Water Consumption, New York City, comments on **"Backflow Preventer Installations."** This subject is of particular interest to waterworks men as well as plumbers. Not only may such back flow preventers be installed in the wrong position, so that they can not operate, but they may frequently be tampered with. Witness the case reported by Mr. Reichman in which a Venturi-type back flow preventer was disconnected and removed because "it was entirely too noisy." In addition to other forms of tam-

pering which nullify the proper operation of the equipment, there are a number of reasons why these devices do not work properly. Improvement in design, clarification and coordination of codes, and dissemination of information on these devices will help to alleviate many of the problems now existing.

We can just hear you say, "But we're not a contractor," when you read the title **Good Public Relations for the General Contractor,** but if you are interested in good public relations or public opinion for your water works or sewage plant, then you will be interested in this manual issued by the Associated General Contractors of America, Inc., 10 Rockefeller Plaza, New York 20, N. Y.

In surveying the interests of our readers we found the subject of corrosion, and surface protection, to be almost tied for fourth place and not too far behind treatment, operation and design. Some of our corrosion interested readers may want a copy of a new technical bulletin titled **Amercoat No. 23 Plastic Coating,** a cold applied plastic coating having general purpose use in

WRITE FOR INFORMATION

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A.W.W.A.

VOGT BROTHERS MFG. CO. Incorporated LOUISVILLE, KY.

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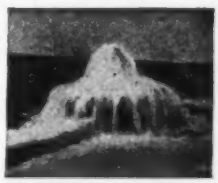
AERO-MIX

AERATOR—MIXER

A Size and Type to Fit Your Problem in Water or Sewage Treatment.



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Pittsburgh-Des Moines engineers are "blue-printing" these civic improvements for forward-looking communities:

- Elevated Steel Tanks
- Steel Reservoirs
- Incineration Plants
- Steel Filtration Plants
- Steel Storage Tanks
- Steel Grandstands
- Steel Bridges

Let Pittsburgh-Des Moines engineers consult with you —for preliminary action on *your* post-war requirements!

PITTSBURGH - DES MOINES STEEL COMPANY

Pittsburgh, Pa. . . . 3418 Neville Island
Des Moines, Ia. . . . 919 Tuttle Street

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The Pioneer Self-Caulking Material for C. I. Pipe

Saves all along the line . . . . .

. . . Engineers and water works operators have been proving it for more than 40 years . . . that *Leadite* saves in material and construction costs, *makes a good tight joint that improves with age* . . . and when the line is laid with Leadite they can forget it with confidence.

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

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WATER WORKS EQUIPMENT

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For
Water Works
and
Sewage Disposal
Plants

EDDY FIRE HYDRANTS
For Fire Protection Service

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VALVE COMPANY
WATERFORD, N. Y.

AMERICAN GAS BOILERS
STEAM AND WATER TYPES
FOR DIGESTER HEATING
SEE DATA PAGE IN ANNUAL REFERENCE SECTION
AMERICAN RADIATOR & Standard Sanitary
New York CORPORATION *Pittsburgh*
SALES OFFICES IN ALL PRINCIPAL CITIES

The day your steel storage tank is filled, corrosion starts its destructive work on the inside. By means of the *RUSTOP System of cathodic rust control*, under-water corrosion can now be banished *instantly, completely* and *permanently* . . . from old tanks or new. No draining, sandblasting or painting. No service interruptions . . . no taste. Costs pennies per month to operate. *Guaranteed.* Write for full information. ELECTRO RUST-PROOFING CORP., Dayton 10, Ohio.

RUSTOP ELECTRO RUST-PROOFING CORPORATION

INSTALLATIONS WORLD WIDE
LARGEST CITY TO SMALLEST VILLAGE

VALVES COMPLETE EQUIPMENT FOR WATER WORKS FILTRATION AND SEWAGE DISPOSAL PLANTS
LATEST "COREY TYPE" HYDRANTS

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ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

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Pioneer Producer of GREENSAND ZEOLITE MINERAL

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THE EDSON CORPORATION
Main Office and Works: 49 D St. South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

a wide range of industries. A post card addressed to Amercoat Division, American Pipe and Construction Co., P. O. Box 3428, Terminal Annex, Los Angeles 54, Cal., will start the bulletin on its way to you.

If your water or sewage plant is large enough to have a machine shop, or if you are a manufacturer with a machine shop, you may be interested in the **New Cutting Tool Catalog No. 44** of the Robt. H. Clark Co., Beverly Hills, Cal. In case you don't know these are the tools employing the principle of "adjustability."

Our Modern Machine Age has brought with it a problem for the grammarian, or at least for those interested in spelling, for although simplified spelling has not been accepted for ordinary words it has been taken up wholesale by the manufacturers and advertisers. Take the name **Punch-Lok** for example, the stream lined clamp and fitting. No matter how it is spelled there is no doubt as to what the name means and if you don't know, write for a new catalog on the Punch-Lok clamp to B. F. Goodrich Co., Akron, O.

During the last several months, in our column "Here and There," we listed fifty house organs that come across our desk. Now comes an announcement that *Printers' Ink* has issued a **Directory of House Organs**, listing 5100 company magazines published by 4016 different concerns. If you want to know the names of the other 5050 send $2.50 to Printers' Ink, 205 E. 42nd St., New York 17, N. Y.

Rex Z-Metal Chain Belts are presented in Bulletin 437 of the Chain Belt Co. of Milwaukee.

REX Z-Metal is a ductile ferrous cast metal with a high tensile strength (more than 30% stronger than good malleable iron), and a correspondingly high yield point. Although Z-Metal is not stainless, it resists the corrosive action of many acids and alkalis which actively attack malleable iron or steel.

Z-Metal chain belts are made in many styles, types and sizes for every kind of drive and conveyor service.

A copy of the REX Z-Metal chain belt bulletin may be obtained upon request to the Chain Belt Co., Milwaukee, Wisc.

How Zinc Saves Steel from Rusting is a booklet issued by the New Jersey Zinc Co. Discussed in the booklet are the functions of metal protective paints, formulas for such

paints, zinc dust-zinc oxide paints, zinc dust-zinc oxide-iron oxide paints, zinc oxide-iron oxide paints, zinc chromate and zinc tetroxy chromate paints. Among the illustrations showing the application of these various paints is one showing "the superior service properties of 80-20 zinc dust-zinc oxide combination compared to other metal protective paints after eight years under water service" in a water storage tank. This interesting booklet on the protection of steel by use of zinc paints may be obtained by writing the New Jersey Zinc Co., 160 Front St., New York 7, N. Y.

Help Wanted

Sanitary or **Civil Engineer** with background of experience including basic knowledge of sewage treatment processes and plant design for a permanent position with prominent sewage treatment plant equipment manufacturer.

Positions open include application engineering in office and development for sales engineering in field. Either type of positions offer excellent opportunity for advancement and provides practical experience in all phases of sewage treatment.

State full details concerning qualifications, type of position desired, starting salary range desired, and personal data in letter of application.

Box 800, Water Works & Sewerage, 330 So. Wells Street, Chicago 6, Illinois.

ACCLAIM

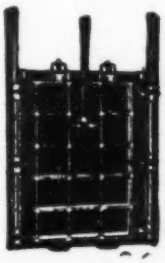
Recent preference indications from hundreds of water works superintendents everywhere show RENSSELAERS (Coreys 'til 1942) as leading.

Some of the reasons for this preference are given in our Bulletin W. May we send it to you?

RENSSELAER VALVE COMPANY

Troy, N. Y.

RODNEY HUNT



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Metal or timber sluice gates of all sizes and designs, approved by engineers everywhere. Improved gate stands and hoists for hand or motor operation. Also flap and mud valves, shear and filler gates, trash racks and rakes. Dependable canal equipment from dam to tail-race since 1840.

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118 Lake St., Orange, Mass., U. S. A.

TAYLOR-*Standard of Accuracy*

COMBINATION pH and CHLORINE COMPARATOR

A portable outfit recommended where test sample is relatively clear and colorless. Model L-3 contains a Taylor-Enslow Chlorimeter base and slide, any two Taylor pH color standard slides of non-warping plastic, 6 Pyrex cells and necessary reagents. Determinations can be made easily, speedily and with absolute accuracy as all Taylor liquid color standards carry AN UNLIMITED GUARANTEE AGAINST FADING.

Model L-3, complete with carrying case — $46.00, F.O.B. Baltimore.

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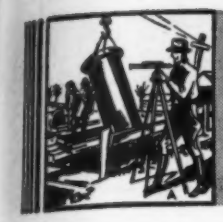

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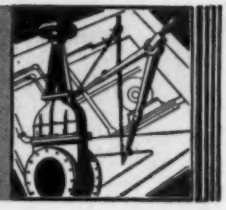

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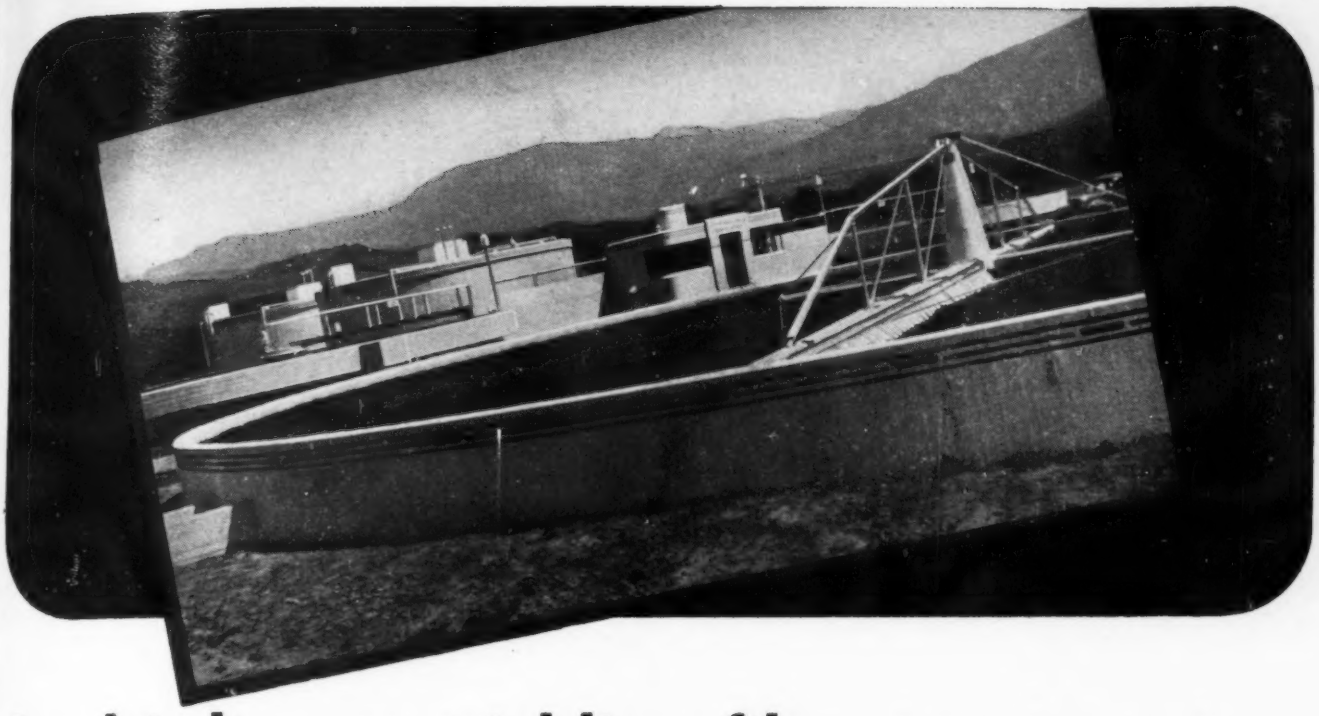

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